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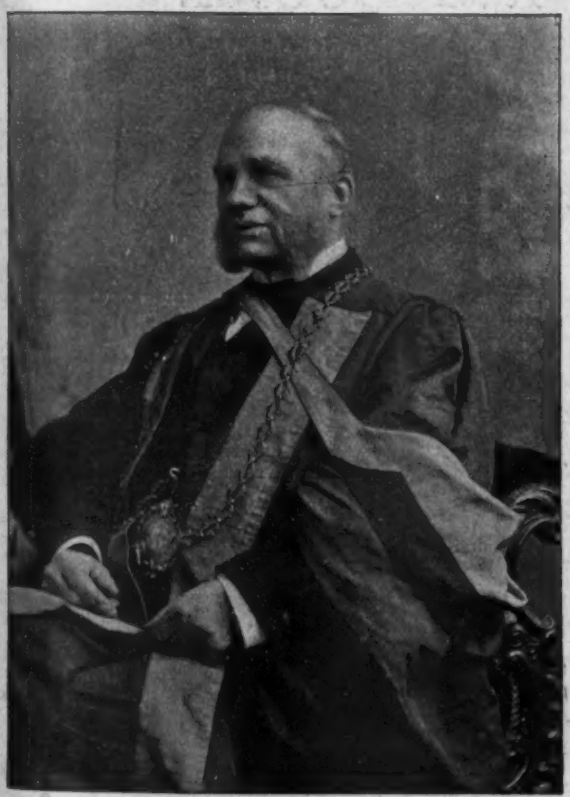

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A MONTHLY MAGAZINE AND REVIEW FOR THE SCHOOL-ROOM AND THE STUDY

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CHRISTMAS LETTERS:

A WAY OF BUILDING "CHARACTER" IN OUR SCHOOLS.

BY CHARLES F. HAYWARD.

THE October number of THE PRACTICAL TEACHER contained an account of my work at the Somerville Road Schools, Birmingham. It was written by a gentleman who called upon me for the purpose of getting "material" for the article, and to whom I confided many of the schemes by which I worked. Among them was the scheme of sending a Christmas letter into the homes of my boys and girls, to be read by them and their friends. I have sent letters now for seven years, and I am strongly convinced that more good has been done by them than I ever anticipated would be done at the time I conceived the idea. I do not know exactly how it came. Perhaps in this way. I had been transferred by the Birmingham School Board from one of the poorest of its schools into one of its then very best and latest. I went in May 1894, and I was so struck by the change of work, the greater influence that seemed to have been given to me, and the greater power of doing good that had come to me, that I felt keen in widening out my methods and my school institutions. I noticed, between May and December, that the children, coming from good homes as they did, were more amenable to my wishes than were the children of my poor school, and that they were more ready to fall in with whatever I suggested for their good than I had been accustomed to. This response seemed to appeal to me somehow, and when the first Christmas came I felt I would like to give a Christmas greeting to them all. I tried a Christmas verse. It did not suit the case. In fact, it was not so good a piece of work as was given to me a few weeks previous, by one of my Standard VI. girls, as an exercise in composition. I dared not submit to a comparison being made between the two. I tried a Christmas sentence. I could not make one complete enough. The sentence developed into a letter. I remember well the care I took in composing that letter. I had to write it for both boys and girls—for those who could read well, and for those who could just spell out words of one or two syllables. I had to write it, too, so that it could stand the criticism of the father, the mother, the elder brother, and the elder sister. And more than all this, I had to write a letter which would not rise up in judgment against me as regards my own speech and conduct during my mastership of the school. I wrote as follows :—

"MY DEAR SCHOLAR,—A Happy Christmas to you! I hope you will spend your holiday in a very joyous and pleasant way. Whether you do so or not, largely depends on yourself. You *can* be happy if you desire with all your heart to be so; for, remember, happiness is sure to follow a kind word or a kind deed. Speak the one, do the other, and mark the effect. Be thoughtful and helpful at home. Do something to please father, something to make mother glad, and everything to make home happy. Play your games earnestly, and make your playmates enjoy them. Do not tire the elder people. Be quiet when they are weary, read your story-book, and give them rest and peace. Think of yourself LAST.

"A Happy New Year to you! Before I meet you again at school, the New Year, 1895, will have commenced its course. What will it bring you—joy? gladness? I hope both. Given good health, you will grow. Will you grow good? You can. Will you try?

> 'Love the kind friends who hold you dear,
> And you will then have a Happy New Year.'

"That you may is the sincere wish of your affectionate master and friend, CHAS. F. HAYWARD."

This letter was given in a sealed envelope to each child—about seven hundred at that time—as they left school on the

last morning before the Christmas holidays. I carefully explained to them that the letter was not to be opened till Christmas morning; they were to put the letter carefully away, and not to be tempted to pry into its secrets, and that they were to prevent any one else from doing so. These instructions, I found afterwards, were kept fairly well. Some children passed through sore temptation. Some of the letters were opened through sheer mischief by older brothers and sisters, and some were opened by business-like fathers, who found the envelope, and were anxious to know why an unopened "circular" was lying about. "Baby" was responsible for the destruction of a few; and, alas, some few, not many, broke trust with me and opened them. To prevent a recurrence of these disasters in the future, my next letter (and all succeeding letters) was enclosed in an envelope, across the front top of which was printed, "Not to be opened till Christmas morning." As far as I know, no letter has since been opened contrary to that instruction.

My first letter went out with many an anxiety on my part. I did not fully believe it would be an acceptable thing. But before school reopened I had many proofs of its being well received. I did not live in the neighbourhood of the school at that time—I lived quite two miles away—and one day, having to fetch something from school that I wanted, I strolled over, and met many of the children, and some with their parents. The kindly looks and friendly greetings I received from children and parents alike were to me ample proof that something had touched their hearts. It was my Christmas letter. Parents thanked me for "being so good," and children told me they liked it. A day or two afterwards—still before school reopened—I happened to go to Dudley. As I was returning by train, my solitary companion in the compartment was a man. We did not speak. Englishmen are noted for their quietness under such conditions. Presently, however, he took from his pocket one of my very letters. I don't know whether I blushed; I expect I did. He read it, and looked at it with, as I thought, some affection. Then he passed it to me, told me what it was, and asked me whether I should like to read it. Of course I said I should, and did so. When I handed it back to him, he said, "Now, don't you think that's a very nice letter?" I assured him I did. "Ah," said he, "that letter has made a great impression on us this Christmas time. It has done us all good. My little niece goes to a school in Small Heath, near Birmingham, and the master of the school gave her and all the children that letter for a Christmas card. She sent it us to read, and I am taking it back to her, and I am going to tell her how proud she ought to be, and how she ought to try to be a good girl. I only wish my little children went to that school." I did not tell him I was the master of the school, and I hope he has never found out how deceitful I was by my not telling him.

That circumstance proved to me that I had hit on a very happy idea. When school reopened, and during all that year, I had instance after instance of the good my letter had done. I was constantly hearing something fresh about it, and from all parts of the country. I determined to keep it up.

The first letter was printed on small letter note paper, but its successors have been issued in a more attractive form. The illustration will show what I mean. I find this adds to the value of it from a child's point of view, and the expense is not much increased. I issue a thousand now, and the cost, together with the envelopes, comes to about thirty shillings.

LINGOLN VILLA,

TENNYSON ROAD,

SMALL HEATH.

My Dear Scholar,

I do not doubt I shall be one of the first to greet you on what I hope will be a very happy day. With all my heart I wish you the old, old wish: A Happy, Happy Christmas!

As I write I am thinking of the many ways there are in which you can be happy, but in a short letter I can only tell you of one of them. It is this. Make home and friends feel that you are like the sun in the sky, shining brightly on a lovely summer's morn, shedding light, turning sorrow into song, making glad the hearts of all. The flowers open, and scent the air with sweetness. The birds sing. The earth is glad. Be a sun. Your light is love. Your sweetness is love. Love makes the home a place of song. The home is glad.

A Happy, Happy New Year! What does this mean—to you? This. May the days, as they come and go, leave behind them no sorrow of heart. May all you do help you to grow gentle, and kind, and true. May you be happy in finding out that to do Right is brave, as well as it is noble and good.

With these best wishes I am

Your affectionate Master and Friend,

CHAS. F. HAYWARD.

Christmas Eve, 1900.

When I saw the success of my first letter, I was anxious to keep the fact of my issuing them as secret as I could, but, from many causes, the secret leaked out. Many of my scholars are sons and daughters of school teachers; some of the children have friends in the profession; I have sent a few out to my own friends, and my teachers have sent some to theirs. The consequence is, that about November each year I have applications from all over the country asking for a copy of one of them, and my permission to reprint and distribute. As I have felt the idea gaining ground, I have never refused to send a copy when I have had one to send. At the same time, I have always advised teachers to compose their own letters, as by so doing, I think, they more closely meet the needs of their own children. Since the issue of the October number of The Practical Teacher I have been asked for copies by seventy-one teachers. When I found the number going up, I sent replies only to those who had the courtesy to enclose a stamp for postage. Anyway, I have sent a large number out this Christmas; and now I am glad to know that in all parts of the country, and even beyond our own shores, children are receiving from the hands of their teachers letters of good will, and affection, and love. I hope the idea will be "annexed" by many more.

A few days ago I received a copy of the *South African Educational News*, a paper published at Cape Town. In it the editor says: "We take the liberty of directing our readers' attention to Mr. Hayward's letter quoted in 'Our Educational Contemporaries' column. The good which these letters of

BRITISH MUSEUM

Mr. Hayward have done is incalculable, and we feel sure that those of us who have the highest interests of our pupils at heart will be glad to hear of so excellent a plan for inculcating a good tone among our scholars." Then a few pages further on in the magazine he quotes at considerable length from THE PRACTICAL TEACHER, and reprints my letter of 1897. Other papers have followed suit. The secret is out. Let it be used now as widely as possible, and let the children of the world be brought by this means into close touch with their teachers. Both will be the better for it, and nothing can come of it but good.

One word more. It is an understood thing at Somerville Road that all old scholars can have a Christmas letter if they either come for it or send for it by letter. This year I have in this way distributed 179, and each post brings requests for others. I always send a copy to eminent educationists of my own district as well as to educationists in various parts of the country. I invariably get a congratulatory note in reply, and one enthusiast, who shall be nameless, sends me year by year a book of his own production. He says he can send me nothing better. His own words last year were: "For lack of anything better, I beg your acceptance of ——, a work I have just managed by dint of hard work to get through this year."

The following letter for 1896 I am very proud of:—

"MY DEAR SCHOLAR,—'Tis the old, old wish—the old but ever new. May your Christmas be a bright and happy one. Ay, your New Year bright and happy too—happy in every way, bright on every side. As your friend I write the wish. As such I hope that LOVE and PEACE and JOY may find a home in your heart. Be loving and lovable. The love you shed around will be gathered to you again. Be gentle in speech, kind in deed. Peace and joy grow in the garden of Love. Peace, the flowers of gentleness; joy, fruits of kindness. How different the harsh word, the unkind deed! Harsh words and unkind deeds are like hailstones in summer time. They beat down and destroy what they would make beautiful were they melted into gentle drops of rain. Avoid them; know them not.

"May this morning bring you great gladness, no sorrow; much happiness, no pain. May the New Year give you strength; and may you strive earnestly for the blessedness that is promised to the meek, the pure in heart, and the peacemakers among mankind.—With best wishes, I am, etc.,

"CHAS. F. HAYWARD."

The twentieth century has dawned. Men of all classes of society are sending or giving twentieth century messages. Ministers of religion are preaching sermons on the twentieth century. This, without presumption on my part, is my message to fellow-teachers. Try the effect of a letter to your boys or girls at school. The tone of your school, however high it may be, will be vastly improved.

TALKS WITH TEACHERS ON PSYCHOLOGY.

II.—MEMORY IN THE SCHOOLROOM.

BY JOHN GUNN, M.A., D.SC.

I.

"MEMORY," says Locke, "is, as it were, the storehouse of our ideas. For the narrow mind of man not being capable of having many ideas under view and consideration at once, it was necessary to have a repository to lay up those ideas which at another time it might have use of. But our ideas being nothing but actual perceptions in the mind, which cease to be anything when there is no perception of them, this laying up of our ideas in the repository of the memory signifies no more but this—that the mind has a power, in many cases, to revive perceptions which it has once had, with this additional perception annexed to them, that it has had them before."

This was Locke's account of memory, and is one which serves the ordinary unscientific thinker very well. But it will not do to inquire too closely as to its meaning, or how an idea which has ceased to be anything can yet be in a repository, and capable of being revived so as to appear once more and be the same idea in the mind.

Hamilton analysed the phenomenon of memory into two faculties. After dealing with the acquisitive faculty, to which he assigns the duty of acquiring knowledge, he tells us that we have "a second necessary faculty, one that may be called the conservative or retentive. This is memory strictly so designated—that is, the power of retaining knowledge in the mind, but out of consciousness; I say, retaining knowledge in the mind, but out of consciousness, for to bring the *retentum* out of memory into consciousness is the function of a totally different function" (the reproductive faculty)..... "This reproductive faculty," he continues, "is governed by the laws which regulate the succession of our thoughts—the laws, as they are called, of mental association."

But we soon find that Hamilton's elaborate scheme of faculties and laws is a barren study as regards any practical utility.

So we turn to Herbart, whose psychology is one of the foundations of his system of education, to draw what help we may from his treatment of memory in the schoolroom. Unfortunately, we do not get much help from Herbart, so far as concerns what in school we usually call memory. Regarding the behaviour of ideas in what he calls the work of apperception, he is excellent—no man more suggestive and helpful; and in apperception, memory, according to Hamilton's binocular view of it, is really the active power. But as regards the "memory" of the schoolroom—the "faculty" of our examination papers—either Herbart has little to say, or his English interpreters have not thought it of sufficient importance to bring it forward. I find only one definite statement regarding memory—namely, that "Herbart defines memory as the power of the mind 'to retain and reproduce presentations in the same form and order in which they were first received,'" and that he distinguishes three kinds of memory—rational memory, ingenious memory, and mechanical memory. But this is neither very helpful nor indeed very Herbartian.

As regards the psychology of memory, Dr. Ward (in *The Encyclopædia Britannica*) is both scientific and, to a certain degree, practically suggestive. He does not take refuge behind faculties and laws, but describes what he actually finds taking place; and, in particular, he avoids the snare into which Herbart seems to have fallen, and which makes his treatment of ideas so terribly mathematical—the fallacy of regarding a given state of mind as composed of separate atoms called ideas. To Dr. Ward any given state of mind is a *continuum*, in presentation and in memory alike, from which those distinct ideas are, by the aid of attention, finally disentangled.

Dr. Ward's article does not aim at guiding the teacher in his dealings with memory; but when the teacher knows and recognises the facts of memory, he can make his own deductions and act accordingly.

In dealing with memory, the teacher will do well to attend to it chiefly as a form of *habit*—of habit as seen in the physical sphere, and as explained by the laws of brain and nerve activity. As a matter of fact, you can only reach the mind of the pupil through his nerves and brain, and by the use of your own. Mind is ever isolated from mind; it is only by the bridge of the physical that communication is possible. Only in so far as you can get the pupil's brain to act in a certain way can you direct his thoughts as you wish. In order to educate, mentally or morally, the teacher should know all he can of the laws of brain activity, for only as he acts in accordance with these laws is education possible.

Do not suppose this view materialistic. All physical energy is a movement of physical particles; and though such movement does accompany thinking, *thought* has never, by any sane thinker, been regarded as itself a movement of physical particles. Nor is it even possible to say that any movement of material particles can *cause* thought, for one physical movement can only cause another physical movement. If the energy of even one vibration were to change into thought or feeling, it would violate the great scientific

law of the conservation of energy, and the total amount of physical energy in the universe would be thereby altered. We may be quite sure about this, that however close be the connection between brain activity and thought, there is no physical causation possible in the case. But the connection is such that we can only reach the thoughts of another by way of his nerves and brain, and that is the main practical point.

It is not necessary here to go into the laws of brain action in any detail. The fundamental laws for us are—*firstly*, that a state of mind is a continuous whole, a series or web all joined together, and tends to recur to memory as a whole. If three brain centres, A, B, C, have once been excited in that order, resulting in the movements L, M, N, and, let us say, accompanied by the mental states *x*, *y*, *z*; then, when A is again excited, the tendency is for B and C to follow in the original order. *Secondly*, habit is formed by repetition: every repetition of the series A, B, C tends to make it more certain that A will always be followed by B and C.

As to the brain, we may figure to ourselves that A, B, C is a new line of connection formed—a telegraph line uniting B and C to A, or a channel which deepens as it is more used. As to the movements L, M, N, we are accustomed to say that movements become easier by repetition—the fundamental law of habit. As to the mental states or ideas *x*, *y*, *z*, we say that *x* is followed by *y* and *z*, according to the law of mental association. Thus we see that the three laws—the law of brain activity, the law of habit, and the law of memory—are but three aspects of one universal law of our life.

It may be necessary in passing to remind ourselves that, so far as brain is concerned, the activity which causes a muscular movement is exactly the same in kind as that which accompanies a mere idea. The movement implies a stronger flow of brain energy, the idea a weaker, but that is all the difference. When we imagine a word or an object, the same brain centres are active as when we speak the word or when we see or handle the object. To the brain, a thought is simply a nascent or a repressed action. This fact will help to make it clear that, in dealing with thoughts and ideas, we are still dealing with facts which require from us a knowledge of brain activity, just as much as when we are dealing with muscular movements and the phenomena of habit in general.

One useful result of attacking memory from the side of brain is this—it will prevent us for ever from regarding memory as a faculty, or even as two faculties, exercised by a special department of the mind, or located in a special region of the brain. Some light is thrown upon the complexity of memory by cases of brain disease or injury. For example, a person may by some brain injury become *psychically* blind, or blind so far as ideas or understanding is concerned. He may see quite distinctly such an object as an orange, but the yellow disc calls up no idea to him; he does not know what it is when he sees it. As soon as he touches the object, however, he recognises it at once.

Such a case as this is very suggestive. In forming a concept or a generic image of an orange, it is no single acquisitive faculty that is at work. There is a whole series of brain tracts stimulated. There are the motor stimulus from touch, the sensory stimulus from sight, and stimuli from taste and smell. After repeated experiences of such grouped stimuli, with a normal brain one actual stimulus is sufficient to arouse the whole of the other centres, which were previously stimulated together. We see the orange; this sensory stimulus discharges into the previously associated centres of taste, smell, touch, and the rest, and we have present to the mind the complex idea of an orange. In the case of the disease mentioned, the wire had been cut between sight and the other centres. The optical stimulus did *not* awaken the others, and there was no memory of other sensations aroused. The sight of the orange failed to recall the concept and name. But the touch connection was all right, and the feel of the orange awakened all its old associates.

There are other phases of brain disease which help to throw light on the great complexity of processes involved in what we often regard as a simple act of memory. A common case is *aphasia*, or the want of power to remember how to form the sound of words. The patient can understand words spoken, but cannot utter the words he intends. Again, there have been cases of the loss of power to understand written or printed words. Though the patient could write spontaneously and from dictation, he could not read what he had written himself.

Such pathological cases throw much light for us on mental processes. There are numerous clues or links of association, sensory and motor, to be established before we form an ordinary psychological concept, and before we can associate its meaning with a spoken or written word. Each of these clues or links is formed by the law of habit, and confirmed by repetition, until we are apt to regard them all as simple instead of complex. Happily for us, the law of habit soon makes them automatic and mechanical, else we should spend a whole lifetime in learning the most elementary facts about our surroundings.

The important thing for us, as teachers, to learn from those pathological cases is just this, that the mind which has not yet formed those connecting links is very much in the same condition as the mind which has formed them and lost them again through disease. It is the work of education to arrange its materials so that useful and permanent brain-paths shall be formed, by giving exercise for the brain in sensory and motor stimulus combined.

While we are still dealing with the physiological side, it may be worth while to remind ourselves that in school we ought to observe the conditions under which such brain-paths can be formed. Unless we can stimulate *brain energy* sufficient, no new paths will be formed, and no old ones will be confirmed. Now, to have brain energy developed, we need a brain in good health, and provided with a nourishing blood supply. The pupil must have sufficient food at home, and sufficient warmth and fresh air in school. The sight stimulus must be adequate, which requires a good light, good type in school books, clear illustrations in diagrams and on blackboard, and, it may be, a pair of spectacles. The hearing stimulus, too, needs attention—clear, simple speech by the teacher, and silence by the pupil. These things combine to fix attention, and attention, in turn, renders the stimulus effective.

There is an old maxim which when translated reads thus: that always to feel the same thing is equivalent to feeling nothing. In physiological language, when one centre is subjected to prolonged stimulus, that stimulus ceases to be effective. Variety, in short, is necessary to brain activity. It is said that one can hypnotise himself by concentrating his vision on one distinct spot. As a rule, when you seem to be watching one small object, the eye is really wandering over it from point to point. This law must also be kept in mind in school, especially in dealing with very young pupils. Repetition of stimulus does not always ensure repeated flows of brain energy; it may result in the absence of it. There must be sufficient variety and change to ensure vigorous brain action and permanent links of memory.

It must also be kept in mind that motor stimulus is more powerful even than sensory, while being of at least equal educational value; hence the unique value of all handwork in school exercises. More deep and lasting connections are formed thus than in any other way.

From what we have said of the formation of concepts, and of the loss of a concept already formed, due to the failure of one of the associative links involved in it, we learn very clearly this fact, that the laws of mental association are at work in the very beginnings of mental life, in forming those generic ideas or psychological concepts of things which constitute our very earliest mental furniture. The *laws* of mental association, we have said; perhaps we should rather say the *law*, for they all resolve into one—the law of habit. And if this be so, it is clearly inaccurate to speak, as we often do, of the faculties developing in a certain order—first perception, then memory, then judgment, and so on. Perception involves memory from the very beginning. Destroy a clue of memory, and the stimulus no longer awakens any perception.

Next Month:

THE STORY OF CANADA.

With Large Empire Supplement in Colour.

There must, however, be some reason for this popular way of speaking of things, by which we treat memory as something apart from perception, and relatively of later growth. The reason is, as it appears to me, a superficial analysis of perception, and a merely popular and empirical use of the word "memory."

Let us take some cases, by way of example, of what we call memory, and try to find entirely similar mental acts which get a different name. If I meet some one to whom I was casually introduced a few years ago, I may still *remember* his face. If I meet a member of my own family, whom I see every day, I do not think of saying I remember him; I simply *know* him or *recognise* him. Yet the mental process is precisely the same in both cases. Again, I *know* that water will quench a lighted match, but I may only *remember* that water will set fire to a piece of sodium. I *know* that the opening by which light reaches my table is called in English the window, and I can *remember* that its French name is *fenêtre*. Were I a Frenchman, the case would be reversed: I should *know* the French name, and perhaps only *remember* with difficulty the English. If I knew both languages equally well, and if I were in the habit of speaking both with equal frequency, I should not use the word "remember" in the case of either name.

Now this difference between the words commonly employed in speaking of entirely identical mental phenomena is significant. To put it shortly, we may say that we speak of *remembering* only such things as we may *forget*. When once a brain-path is so firmly established as to become part of our permanent brain structure, or a mental association established so as to become an inevitable habit in our thinking, we no longer use the word "memory" in relation to it. We use the word "knowledge" or "recognition" instead. And yet all knowledge or recognition begins as memory. Only when the habit is ineradicable do we drop the word memory in speaking of it.

Why, then, is memory regarded as a faculty later in its development than, say, perception? Chiefly on this account, I think: In early life—in early childhood, that is—the mind is dealing only with things near, common, and destined to become part and parcel of our daily life. At a later stage the mind is directed to a wider circle of ideas, of language, and of facts regarding distant times and places, and here the contact is more fleeting and inconstant. The mental connections never reach that degree of firmness which we call complete knowledge or recognition. The facts are such as may be forgotten; if they are not forgotten, we say they are *remembered*. Hence memory comes to be regarded as later than perception; in reality it might be regarded as earlier, because necessary to the beginnings of perception. But perhaps we are more scientific in taking them as simultaneous, because we never find them dissociated.

This seems to be as good a place as any to notice a common objection to much of our school work—namely, that we train only the memory of our pupils, and not their other faculties. It is difficult to state this objection without using that terrible word "faculty," which has led to so much error in dealing with the facts of mind.

Now we have seen that the word "memory" is only used in popular language when mental habit, the true memory, is imperfectly established. When this fundamental memory is complete, we call it knowledge. So the objection really seems to imply that, instead of training memory too much, we do not train it enough. We leave things in the stage where they may be forgotten, which is, as we saw, the stage popularly known as memory. This may be some comfort to us, after all: when we are told that we make too much use of memory in our work, it means that we are not using memory enough. We may be pleased with the thought that our critics don't in the least know what they are talking about.

But we must go a little deeper than this. The common objection referred to may not mean what it seems to mean; popular language rarely does. Yet it indicates, in its half-articulate fashion, that there is somewhere a grievance against us; that there is a flaw in our work. The uneducated man may be quite sure that he is unwell, though his diagnosis of the trouble may be grotesque and impossible. To prove his diagnosis wrong, does not prove that his health is right. Let us see, then, if we can diagnose better the disease in our education which is commonly called an over-use of memory.

One common form of error, I think, is in the *matter* of our teaching. When we are dealing with things familiar and near at hand, as we said, memory soon becomes ripened into knowledge and recognition. When we deal with things strange, or distant, or uncommon, the facts we impart remain in the stage of memory—that is, they are liable to be forgotten. Now I fear that in our school work we are too fond of spreading ourselves over the strange and distant, to the extent of forgetting the educative value of what is close at hand and familiar. Solomon has a word for teachers in this matter: "Wisdom is before him that hath understanding; but the eyes of the fool are in the ends of the earth." Let us inscribe this motto and warning on the front page of our books of object lessons, our books of geography lessons, and our books of history lessons: "The eyes of the fool are in the ends of the earth." The common things of daily experience give better material for education than the uncommon and the unfamiliar. The ostrich and the camel are apt to be greater favourites in our so-called object lessons than the common domestic animals and birds our pupils see every day. Sharks and whales seem more striking objects than the contents of the fishmonger's window, which find their way to our breakfast tables. The palm-trees of foreign lands are more attractive to us than the plants of our roadsides and gardens. But this is a mistake educationally. We want our teaching to result in *knowledge;* we should, therefore, begin with objects which can be thoroughly *known* by the pupils. We should select what is nearest, and give our lessons on what is every day before their eyes. Thus the new facts fuse with the partly-known objects, and become matters of recognition and not of mere memory. Facts about glaciers and icebergs may be remembered, or may be forgotten; they will, at best, be matters of memory to those who have no opportunity of seeing the objects described. Facts about our own surroundings, about our clouds and rain, our snowstorms and frosts, our little streams of water and their work, can soon be made to pass beyond the sphere of possible forgetfulness, and to form part of the permanent mental furniture of our pupils. "Wisdom is before him that hath understanding."

This principle of selecting the familiar does not mean that we are always to confine our pupils to their immediate surroundings. It only means that the first step is to understand these thoroughly. Once they have reached that stage, knowledge of the distant and uncommon has a sure basis. There are then so many principles known that even the uncommon things of other lands can be understood from their connections with familiar things; hence there are bonds of common principles available for explanation, and the unknown is linked to the known so closely that it too becomes known and not merely remembered.

The extreme stage of the disease we are dealing with is reached when we give children facts to remember which they *cannot* understand, and which are of no practical value to anybody to remember. To understand or know a thing means to know its relations to other things. Now, we do occasionally sin, or we are accused of sinning, in this way, that we give children facts to remember which we do not connect with any other facts in their experience, although there may be a relation perceivable by more mature minds. Such facts may be found among our grammatical rules, or our dates and events in history, or our data in geography, or elsewhere. But even here the real error is not so much that we are exercising the memory as that we are exercising it upon wholly useless tasks. Suppose you teach your pupil that Arthur's Seat is 827 feet high, and that Ben Nevis is 4,406 feet high, and leave the matter there: all the relation so far expressed is the relation between the height of each of these hills and the length of a man's foot, or its probable length when the foot-measure was so named. And this relation is expressed in a number so large that it conveys little real knowledge to the mind. But if you take another set of relations, and tell the pupil that Ben Nevis is five times the height of Arthur's Seat, you give a bit of information which will help an Edinburgh boy to form some mental picture of the height of Ben Nevis. True, it is not a fact in itself of

much importance, but it is, at any rate, so expressed that the memory of it is in a fair way of becoming part of his real knowledge, and will help as a step to something further by-and-by. You are still exercising memory, you will observe, but the material is in a more practical and reasonable form. Instead of being able to *remember* the exact height of Ben Nevis, the boy will be able to say he *knows* something about it; for he already knows Arthur's Seat by sight, and he knows it in such a way that the number 827 tacked on to it does not much help.

There are many things which every one is bound to learn nowadays that seem as if they must be left as pure matters of memory; there is no reason in them. Examples, I daresay, are only too common in the experience of us all. Take, for instance, our tangled mass of tables of weights and measures. It seems as if nothing would save us here but the good old Scots maxim of setting a "stout heart to a stey brae." And yet even here there are better and worse ways of setting the memory to work.

Let us turn to our measures of length, the foot and the yard, and what is even worse, the square foot and the square yard, the cubic foot and the cubic yard. Well, one way of setting to work—I shall not say a common way, but *one* way—is to sit down to those tables and learn them by heart; go over and over them again, so that we can *never* forget them. And when they *are* forgotten, as they always are, we repeat the process. A step in advance would be to begin with the *things* themselves—a foot measure and a yard measure. A boy who had handled and used these would at least remember which was which. He would not be so ready to tell us that there are three yards in the foot. That is one difficulty avoided, and, mark this, it is not avoided by avoiding memory exercise; it is avoided by *additional* memory exercise, by adding to the names and numbers the memory of the things themselves.

Now comes square measure. Why nine square feet in the square yard? Why not six, or a dozen, or ten? Boys have so many numbers to remember, which is it to be when the table gets hazy? Fall back on a simple relation to the *known*. Let the boy draw a square yard, and divide it up into square feet for himself. Three rows of three each: it *must* be nine; it can't be ten now. Once more he remembers the numbers, but he remembers something more. He remembers their relation to a familiar fact. He now *knows* that there are nine square feet in the square yard; it is no longer a question of merely remembering.

So, when he comes to solid measure in his table, there are 27 cubic feet in the cubic yard; but to-morrow he may make it 25 or 30. Not if you give him a little more to remember than the mere number. Give him the diagram of a cubic yard divided into cubic feet. There are three horizontal slices, and each of them cuts up into nine blocks built on the nine square feet of the area or plan. Three nines undoubtedly make 27: now he *knows* his table; he does not merely remember it.

(*To be continued.*)

DECENTRALISED TECHNICAL EDUCATION.

WHAT THE SMALL TOWNS OF EAST PRUSSIA, POLAND, GALICIA, SILESIA, AND BOHEMIA ARE DOING.

SINCE the appointment of Mr. Sadler as Director of Special Inquiries and Reports, strenuous efforts have been made to convert England from her infidelity in respect to education, by showing how implicitly the intelligent foreigner believes in that universal education the effects of which—a woman of culture like Lady Colin Campbell has the temerity to say—constitute the great danger of the twentieth century, into which we are at last fairly launched! Three bulky tomes have borne eloquent testimony to the advances made by our Continental competitors in the equipment, both technical and humanistic, of the workers in the great urban centres, and still England remains unconverted, as is shown by the recent jeopardising of the Higher-Grade and Evening Continuation School. The report now before us, for which we are indebted to Mr. James Baker, F.R.G.S., carries the argument one step further, and shows with what intelligent zeal technical and commercial schools are being set up in towns with from five to twenty thousand inhabitants.

O ye of little Faith!—Mr. Baker, like all Englishmen who have applied themselves to the question of the conversion of their countrymen from their conceited self-complacency as to the future of English industries, which Providence is to preserve to us whilst we sleep, is a weeping prophet, since he feels himself foredoomed to become a voice crying in the wilderness of disdain; hence his cry, "Can we in England ignore this wave of intellectual progress, and regard with complacency any delay in the further development of technical and commercial training at all parts of the United Kingdom where trade and manufactures prevail?"

Let the Board of Education reply.—On the 3rd September the Bradford School Board opened a new commercial school for boys at Calton Street, to provide, as is now done in Scotland and in most Continental countries, a sound elementary commercial education, leading up to the more advanced work of the City Technical College. The recognition of this school by the Board of Education was sought by the Bradford Board, to whom the Board of Education replied that the Higher Elementary School Minute was framed for the establishment and maintenance of schools of science of an elementary character where such were needed. The school proposed seemed to be of a different type, and **therefore could not be recognised!**

The Humour of it.—We thus have in this country a truly ludicrous state of affairs. On the one hand we have the Board of Education sending out men to spy out the strength of foreign lands, presumably for the behoof of school managers and teachers who, forsooth, when they go and do likewise, are surcharged, snubbed, and treated as rebellious disturbers of the Queen's peace. Wherefore, when we read of the well-equipped primary school which real compulsion causes to be well attended; when, moreover, Mr. Baker tells us of the Evening Continuation School which the apprentice must attend under pain of penalty for both himself and his master; when, further, we are told of the technical schools that cater on the spot for all trades, and for all craftsmen and craftswomen; when, in a word, the vigilance of the German and the Austrian is held up to our admiring gaze as touching all matters, from the illustrated poster to the steam-engine, we turn in bewilderment to the Board of Education, and ask in wonder why the authorities take so much trouble to show how criminally careless they are of the true interests of the British proletariat.

An industrial Sedan!—The only solution of this problem that presents itself to us is that we have lately had no trade depression, and we suppose that our educational Solons are awaiting an industrial Sedan before setting about the creation and development of a solid foundation for our industrial system.

Our many Advantages.—Mr. Baker, whilst recording the progress made in the districts he visited, does not fail to see that the workers suffer from many hindrances wholly inoperative in England, the chief of which is the interruption caused by conscription. This the Germans themselves admit, as witness the following colloquy:—

"Must this lad," asked Mr. Baker, "give up this handicraft, at the moment his hand and eye are so trained, and be for three years a soldier, not touching a tool?"

"Yes; he has to join next year," was the reply.

"Why, he will lose all his sense of touch and accuracy."

"He will lose a great deal of it," was the response.

"And here," comments Mr. Baker, "as I have said before, is the opportunity of the English artisan to get abreast in culture of these Continental artist craftsmen: he has not to lose these three years, or at least two years, with the colours."

No, we say, but he loses them as errand boy or as "camelot;" and only when he has married a wife, and finds how terribly overstocked the market of untrained labour is, does

he blame himself, and all who had to do with his training, because he has not learnt a trade.

Concrete Examples from the Report.—We would fain give lengthy extracts concerning all the centres visited by Mr. Baker. This, of course, is impossible. It is also, fortunately, unnecessary, as the volume is procurable from the Queen's printers for the modest sum of sixpence. We shall, therefore, be content to draw attention to one or two striking accomplishments in unlikely localities.

Trautenau (Population, 16,000).—This little town of Bohemia is the centre of the Austrian linen industry, the other important trades being jute, building, and cabinet and locksmiths' work. The technical schools are—(1) the **Commercial School,** with 60 pupils; (2) the **Trade Continuation School,** with 230 pupils; (3) the **Agricultural and Flax-growing School,** with 36; and (4) the **Handreadiness School,** for card and wood work, with 60 pupils.

Compulsory Attendance for Apprentices.—All apprentices must attend the trade continuation school from six to eight each evening, and from eight to twelve on Sundays. The instruction is free, except that 1s. 8d. per annum has to be paid for materials, from which poor scholars may also be absolved.

Masters compelled to allow Apprentices to attend.—Clause 100 in the law of February 23, 1899, says: "It is the duty of every master of every apprentice who has not reached the proper standard of instruction to find time for him to attend the continuation school, and to see that he regularly attends. Every master who does not do his duty in this respect can not only be fined, but can also, as by Clause 137 of the same law, have the right taken from him to receive apprentices."

Seven Years instead of Three.—If the student comes up for his military service with a bad report from the school authorities, he has to serve seven years with the colours instead of three.

Turnau (Population, 6,500).—In this little town is located an important industry—to wit, the manufacture of jewellery; and it is noteworthy that not only is Austria assisting in the development of each centre by the creation of special schools, but, further, trade museums, wherein may be seen excellent specimens of the craftsman's skill and art, are everywhere, as at Turnau, springing up, the object being to accustom the eye to models of the highest and of the most varied types. The schools to be found in Turnau are—(1) **Royal Imperial Trade School,** for jewel-cutting, etc.; (2) four **Volksschulen**; (3) a **Bürger or Higher-Grade School**; and (4) a **Continuation School,** in winter, for handicraftsmen. It is only necessary to read the report to realise the loving care bestowed on this attempt to make Turnau second to no other town as a centre of jewellery manufacture, and also to appreciate how the craftsman is incidentally humanised all along the line, to his own advantage no less than to that of his country.

Beckyn (Population, 2,114).—Surely it will put English obscurantists to the blush to read what Mr. Baker has to say about the pottery village of Beckyn. An excellent technical school is planted here, in an old building that was altered at a cost of £1,760. It is attended by fifty-six students for six days a week, from 8 to 12, and from 1.30 to 6 p.m. The yearly expense of the school is £1,440, exclusive of the upkeep of the building, which, as usual, is paid for by the local community. There are also a Volksschule and a Bürgersschule.

Each year excursions are taken to Pilsen and Budweiss to enlarge the views of the pupils, and care is taken to place them well after their term of instruction is over.

Tremendous Strides.—We commend Mr. Baker's concluding words to those who are responsible for English education, all the more so because we believe that it is the powers that be that stand more in need of conversion than do the plebeian rank and file, whose only fault is believing with pathetic trust in the egotistical inanity that we Britons hold our industrial supremacy by a species of divine right:—

"The tremendous strides in advance made during the last twenty-five years by the countries I have been describing is irrefutable proof of the enormous aid given to commercial prosperity by this education; and if in the coming generations Great Britain is to hold her supremacy, which is already so much threatened, the inhabitants of the smallest towns in the United Kingdom must have the opportunity of learning in a scientific manner the trades of the district; and every villager should be trained to study nature with an intelligent eye, and to appreciate the beneficent value of the natural products which lie around him.

"Our aim, as the greatest colonists of the world, must be to build up an intelligent race of handicraftsmen and highly-skilled artisans, and thus to secure for ourselves some of the advantage which must otherwise fall to the share of other nations, whose system of education has made their workmen more keenly alive to the economic significance of improved methods of output, and to the commercial value of more artistic design and cleaner finish."

OBJECT LESSONS IN HISTORY.

III.—ST. BARTHOLOMEW'S CHURCH, WEST SMITHFIELD, LONDON.

WHICH of all the history lessons received in our childhood has held first place for picturesqueness up to the present? Would not a plebiscite of the men and women we pass and repass day by day put the story of the *White Ship* at top of the list? And that which has been will be again; for though modes may vary, human nature remains substantially the same, which is the reason that every teacher finds a listening class with glistening eyes when he first tells them the story of the king who never smiled again because his only son, who he proudly hoped would succeed to the throne, lay under the waves that washed the Norman coast.

London children, especially those of the central and eastern districts, have an additional reason for remembering the story of the smitten king and his generous young son, who lost his life in the gallant attempt at saving his sister's, because in their midst is a famous building that owes its origin to that sad event.

The loss of the young prince sent over the country a wave of serious thought, and many frivolous persons then renounced their former habits and became religious; the richer of these went so far on the road to repentance as to found monastic houses, in the hope of atoning for their past.

Amongst these was one **Rahere,** who, it is said, had been a boon companion of the drowned prince. His natural temperament may be judged by the fact that he was the king's jester. Henry the First, who was never again seen to smile after his son's death, would no longer require the services of that one-time inevitable adjunct to a court. Rahere himself, it seems, was genuinely impressed with the fate of his royal friend, and perhaps deeming it, in accordance with the views of those times, a visitation of Providence not to be trifled with, he set about securing his own salvation by certain acts that a strong, healthy young man would feel some personal as well as spiritual satisfaction in performing. Thus we find him on pilgrimage to Rome, and soon after his arrival there, he nearly lost his life by malarial fever. On his homeward journey he was granted a vision, which also was in accordance with the expectations of the times. The apostle Bartholomew appeared to him, and directed that on his return to London he should found a hospital for the sick and the aged, and should also build a church, to be called **St. Bartholomew's,** outside the city wall, in Smithfield. His first act, when safely home, was to beg Henry the First to grant him some land in the spot indicated: the bereaved king, we cannot doubt, felt a sad pleasure in thus memorialising his lost son. And so, in 1123, the church was built, with a monastery of the Augustinian order and a hospital attached. (In former times hospitals were invariably associated with religious fraternities. It is a comparatively modern feeling that allows lay individuals to found them.) The beautiful buildings were complete—and how beautiful they were can be gathered to-day from a visit to what remains of the church—and Rahere became the first prior. For some years he lived his peaceful, quiet life, between the

monastery and the hospital, out there in the open country: seven and a half centuries ago this neighbourhood was not the centre of a human beehive, as it is to-day. In a good old age the old prior died, and was buried within his church, there by the noble Norman pillars on which his eyes must have rested frequently during their erection. And there he still lies, after the vicissitudes of all these centuries; and the children can be taken to see his tomb and effigy, also they can see a part of his prior's dress, in which it was the custom to bury such ecclesiastics. Although his folded marble hands are still lying as when first placed there, the tomb has not been allowed perfect rest all these years. Once, and not very long ago, when workmen were engaged in the restoration which makes our visit now so great a pleasure, they accidentally broke into the tomb with their tools, and came upon those relics which you see now in a glass case in the north aisle. The children like to gaze upon the leather fragments of the prior's sandal—a **sandal** to symbolise man's pilgrim state on earth; and they like to reflect on who was the shoemaker—how he dressed and lived, and what remuneration he received for his work: they cannot understand that he was satisfied with less than a penny a day. But a lesson on the workmen of the Norman period—their wages, and their guilds, and their social life—comes all the nearer realisation because they have seen so small a tangible link with that far-off time in this little bit of leather.

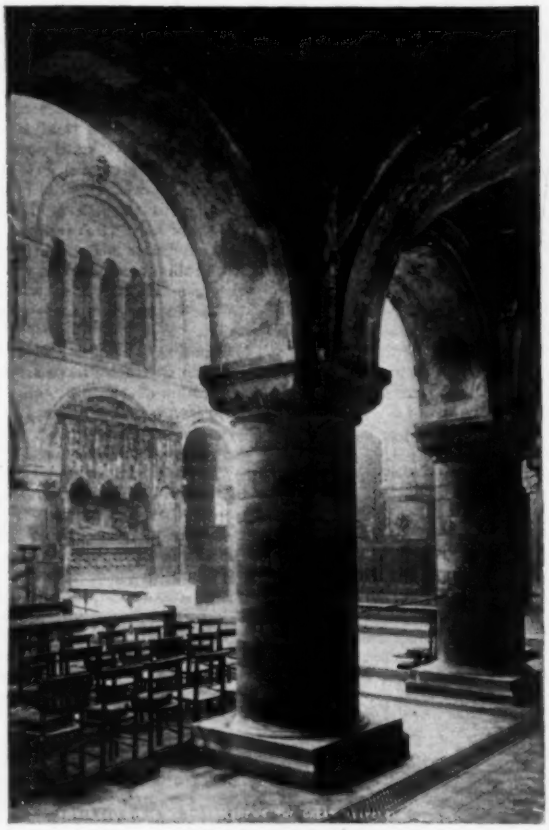
Before leaving the church one can point out to intelligent children a few architectural features, and the teacher can look out for himself for those Byzantine touches said to be there, because at its foundation those Greek merchants were present who gave some suggestions.

If the children know anything of the dissolution of the monasteries by Henry the Eighth, and its consequences, they will not be much surprised to learn that in this edifice has been carried on a fringe-making business, also a blacksmith's, and, in quite recent days, a school in the gallery. Such are the ups and downs to which historic buildings are subject; but the present is the golden age of all antiquities, and therefore we see this most interesting structure much as it was in the days of Prior Rahere.

Passing out of the church into the porch, the visitor is likely to be asked to purchase some seed of the **Calvary clover**, in aid of the restoration funds. This little thing seems somewhat an appropriate source of revenue to a building that arose in the days of superstition. When you have paid your sixpence and brought away your seed-vessel, you must keep it till the following Good Friday, then plant it, and on Whitsunday, as sure as fate, up springs the little clover with leaflets on which are red spots of a purple heart-shape, dear to the faithful as being the sacred blood botanically commemorated year by year. Later on legumes are formed: they are spirally twisted into a ball; when ripe they can be untwisted into a very striking crown of thorns. Botanists describe this plant as a member of the Leguminosæ order, and speak of it technically as the *Medicago maculata*. Cornish people know it well, for it abounds in their county, and, like most familiars, is rather despised than valued there, as the farmers find it too plentiful for the welfare of their crops.

With this little souvenir the visitor makes for the western door, and is soon out in what remains of the once large churchyard. Around it are some real old London houses, which offer a capital example to a child of what is meant by old London.

Just beyond is the hospital of St. Bartholomew's, so well known to little London sufferers of the adjacent neighbourhoods, some of whom have been nursed back to health in "Prior Rahere's Ward." The building contains many things of interest, but it would not be well to seek admission to them for children. However, if they have had in their history lessons a little account of annual fairs, they may be told that just in this open space in front a pleasure fair used to take place yearly from the time of Henry the First, who granted the privilege, to the days of our present Queen. The proceeds of this festivity were given to the funds of the church. It was abolished because of the lawlessness that in modern times came to be associated with it.



RAHERE'S TOMB.

Being on classic ground, the teacher-guide can scarcely turn away without taking his little group a few minutes' walk further, to the stone at an angle of the meat-market wall, which is on the spot where many martyrs perished in the days of religious persecution.

And as another spot with quite a different interest, but one very attractive to youngsters, is also very near, a few minutes is well spent in crossing the road to **Pye Corner**, where the great fire of London ended, after having made its way from where it began in **Pudding Lane**. A public-house there is called Pye Corner, and stands on the site of a predecessor that escaped the flames. It still has a sign—a boy—as it had in the days of Charles the Second; not the original boy perhaps, but still a good example of house signs of the period which first saw his prototype there.

St. Sepulchre's, with all its old London associations, is near, but should, if taken at all, form the subject of another visit; or it may be looked at well now, and talked about in school in subsequent history lessons.

St. Bartholomew's is enough in itself for one outing, and the tale of the *White Ship* will be read with renewed interest by the little antiquarians who have visited Rahere's tomb. Mrs. Sigourney's pathetic little poem, entitled "He Never Smiled Again," will also be a certain favourite after this expedition to St. Bartholomew's.

(If any of the readers of our series of papers on OBJECT LESSONS IN HISTORY have organised school visits to places of historical interest in their respective neighbourhoods, and would be good enough to let us know what educational results they believe to have followed, we should be glad, for the good of all, to make them known in our next issue.—ED. *P. T.*)

Our Monthly Retrospect

EDUCATION IN ENGLAND.

N.U.T. NOTES, ETC.

BY T. B. ELLERY, F.R.G.S.,

President of the National Union of Teachers, 1895-96.

The Birkdale School Board Apologists. THE apologists for the minority of the Birkdale School Board must be in a very bad way, if one may judge from the booklet entitled *The Story of an "Educational Boycott,"* just issued. And, first of all, the careful reader will observe that while it was perfectly right for the bare majority—four to three—to dismiss a teacher, it was *not* right for the minority, when it became the majority, to dismiss another teacher who, in the opinion of the N.U.T., had been guilty of unprofessional conduct. The writer of the pamphlet talks of "The Pretext for Dismissal," "The Head-Master Betrayed," "Relentless to the Last," evidently forgetful of the fact that those very headlines might well be used to indicate the policy of the Board towards the late head-master, Mr. Mortimer, who has since passed away. The apologist makes some curious admissions. One of these, referring to Mr. Mortimer, says, "He had not been a robust man." Well, did the Board take this into consideration when drawing up the notice of dismissal?

The Apologist prints one Letter and summarises another. Perhaps the most extraordinary part of this truly extraordinary document is the insertion of the merely formal letter of the President of the N.U.T., and the omission of the longer letter which followed it. The author contents himself with a summary, but every honest man and woman will ask why the letter wasn't given in full.

There can be only one conclusion—the apologist did not care to publish it. People will put their own construction upon this omission, and will be able to judge how far the writer is actuated by a desire to arrive at the truth, the whole truth, and nothing but the truth.

An attempt is made to show that the good man is unprejudiced, and is giving a calm and dispassionate review of the proceedings. No one will be deceived: the "unprejudiced" air is a clumsy failure. The writer has really done the N.U.T. a good turn: he set out to curse, but his revilings and bitter partisan attack will tend to strengthen the position of the Executive. The fact is, the apologist has given the case away.

Why was the Discipline at fault? In March 1898 Her Majesty's Inspector reported on the Birkdale School (Mr. Mortimer being at that time the head-master): "A large number of the children were listless. At present the control over the children does not appear to be firm enough to remedy this evil."

Can any one be surprised, in view of the continual Board meeting discussions as to corporal punishment? As the apologist says, "During no fewer than four Boards some members protested against this state of things" (meaning the use of the cane), and finally—also in the words of the apologist—"the Board puts its foot down." Corporal punishment was to be limited; a punishment book was to be kept; head teachers only were allowed to punish, etc., etc. No one defends corporal punishment when improperly administered; but does any sane man believe that these discussions could go on at meetings of the Board, and in public generally, without detriment to the discipline of the schools under that Board? Of course, the inevitable happened: the control over the children was not "firm enough," and consequently Her Majesty's Inspector condemned the school. Who can wonder at it? What teacher in the country, knowing the facts, would undertake to serve the Board in the capacity of teacher? And if this "Story" is all that the apologist can produce against the N.U.T., then the Executive need not trouble to issue a reply. An *official* reply is, I should say, out of the question.

Teachers as Members of School Boards. The teacher candidates made an excellent show at the School Board elections throughout the country, and although it is rather late in the day to refer to the matter now, it may be interesting to PRACTICAL TEACHER readers to have the complete return. One's only regret is that a teacher cannot always be found to fight the battle on behalf of his brethren, though one readily admits the difficulties in the way are in many cases almost insuperable. Success in the past, however, will probably lead to some sort of organisation in the future, and then all the large Boards, at any rate, will include teacher representatives.

The return referred to above is as follows:—

London—Mrs. Adams and Messrs. Barnes, Cresswell, Gautrey, and Macnamara.
Birmingham—Mr. Ansell.
Bradford—Messrs. Cryer and Johnson.
Leeds—Mr. Peaker.
Leicester—Messrs. Gould and R. G. Waddington.
Manchester—Mr. Wardale.

It must not, of course, be forgotten that teachers are to be found on other School Boards—elected a year or so ago—as, for instance, Mr. Richard Waddington of Bolton.

The Tenure Question. Sir John Gorst's reply to Sir Joseph Leese on the question of reasonable security of tenure has raised the hopes of teachers all over the country. Sir John's reply was quite definite,—

"Yes, sir, it is the intention of the Government to deal with the question of the dismissal of teachers in elementary schools in the session of 1901."

The next and all-important consideration is, *What form will the appeal take?* Is it to be an appeal to the Board of Education, or will the Bill provide that the aggrieved teacher may take the case into the law courts? If the former, then it seems that in all disputes the Board of Education will send an inspector to the locality, with instructions to make a full inquiry. Assuming this to be the method of procedure, the inspector will in due course report to the Board of Education, whose decision will then be made known, and this decision will be binding on both parties. Will this be a satisfactory solution? With all respect to the Board and its desire for absolute justice, it is fair to say that such a method of settling disputes may not always result in justice being done. In any case the teacher concerned should be permitted to secure the best legal assistance the N.U.T. can give him, for it is not likely he will be able, while disturbed in mind by the receipt of the notice of dismissal, to present the facts in the best possible manner at the inquiry.

On the whole, it would seem that an appeal to the Board of Education and to the law courts would be the most satisfactory solution of the tenure question. One must, however, see the Bill itself before he can arrive at a decision; and if the Government is really in earnest in the matter, we may not have to wait long. In the interests of education an early settlement is not only desirable, but is absolutely necessary.

A recent Tenure Case. The writer of these "Notes" has recently inquired into a dismissal case which is a specimen of many cases which come under

the notice of the Tenure Committee of the N.U.T. A vicar is assisted in the management of this particular school by eight laymen, all of them men of position, and all of them as well qualified to judge of school matters as the vicar himself. They were called together by the clergyman, who at the meeting said it was desirable to dismiss the teacher. The other managers, after hearing the facts as presented by the chairman, were of opinion that the teacher ought not to be sent adrift; and if the question had been put to the vote, the vicar would undoubtedly have been badly beaten. Seeing this, he produced the trust deed and read it, drawing particular attention to the clause providing that the vicar of the parish for the time being had the sole right to appoint and dismiss the teachers!

These eight good men, therefore, saw they were managers only in name, and quietly withdrew. Their subscriptions had been regularly paid, but that was the only duty which was clearly defined, and it now remains to be seen whether these payments will be made as regularly in the future as in the past. The point which seems to claim attention is this: Ought it to be possible for one man out of nine to have the power to dismiss a teacher when the other eight desire to retain his services? This is the sort of thing which is driving teachers out of church schools to seek employment in Board schools—often to their advantage, be it said. When certain of the clergy find they cannot obtain the services of suitable men and women for the schools in which they are interested, they will realise they have sadly blundered. That day, if one read the signs of the times aright, is not far off. In the case under consideration a settlement may yet be effected, in spite of the strong line adopted by the vicar; but if not, then the members of the Tenure Committee will face the matter in the only way open to them. Justice must be done, whatever the consequences may be.

The Vice-Presidency of the Union. The contest this year promises to be as keen as ever, for the candidates are strong men, and each deserves to win. Once more we have Messrs. Coward and Croft, and there are two new men—Dr. Beach of Macclesfield and Mr. W. Muscott of Garsington, Oxford; the contest, of course, lying between the first three, all of whom are strongly supported.

If last year's polling is any guide, Mr. Croft will win; but it is never safe to prophesy in the V.-P. election. One may, however, be permitted to express the hope that the members of the Union will do their duty *and vote*. The voting papers are sent to each individual member, and the postage is prepaid, so there is no difficulty in the way except apathy.

The treasurer, Mr. G. M. E. Hamilton, is again unopposed.

The Executive Election. If all the candidates nominated go to the poll, there will be a contest in eleven out of the twelve divisions, the exception being No. 11 (East London), where the three sitting members—Messrs. Blackburn, Hole, and Hurden—are unopposed. The following is the complete list:—

No. 1 (North England)—Messrs. Atkinson (Cleator), J. Harris (Barrow-in-Furness), *T. J. R. Hindmarsh (Durham), *T. G. Hughes (Newcastle-on-Tyne), I. G. Maguire (Gateshead), G. Oglethorpe (Cockermouth), and J. L. Phillips (Maryport).

No. 2 (Lancashire)—Messrs. *J. E. Holden (Manchester), *A. R. Pickles (Burnley), *G. Sharples (Manchester), and J. Wright (Liverpool).

No. 3 (Yorkshire)—*Miss I. Cleghorn (Sheffield), and Messrs. A. B. Moorby (Hull), *F. Peaker (Leeds), and *T. P. Sykes (Bradford).

No. 4 (North Midland)—Miss Selvage (Hainton), *Dr. Beach (Macclesfield), and Messrs. *G. Baddiley (Burslem), *A. Croft (Nottingham), and R. N. Lewis (Langworth).

No. 5 (South Midland)—*Dr. Macnamara, and Messrs. *J. T. Boulter (Leicester), H. N. Cohen (Birmingham), W. Muscott (Garsington), and *G. J. Rankilor (Birmingham).

No. 6 (East Anglia)—*Miss Broome (Ipswich), and Messrs. J. Baldwin (Bedford), *T. B. Ellery (Luton), *F. B. Gale (East Dereham), and G. E. Lenton (Peterborough).

No. 7 (South England)—*Miss Goodwin (Southampton), and Messrs. *A. S. Caudle (Reading), F. Gudgin (Croydon), F. J. Holdaway (Sidlesham), and *H. W. Sandford (Gosport).

No. 8 (West England)—Messrs. *T. Butland (Kingsteignton), *H. Coward (Bristol), *R. R. C. Gregory (Castle Cary), J. Williams (Swindon), and A. Winfield (Backwell, West Town).

No. 9 (Wales)—*Miss H. Williams (Cardiff), and Messrs. *W. C. Jenkins (Swansea), *T. John (Llwynypia), and H. Lewis (Llangollen).

No. 10 (North London)—Messrs. *J. J. Cullum (Chequer Street, St. Luke's, E.C.), J. B. Johnson (Ealing Dean), *T. H. Jones (Burghley Road, N.), J. Kelly (Holmes Road, N.W.), R. Munks (Acton), and *W. Thompson (Notting Hill, W.).

No. 12 (South London)—Messrs. *T. F. Bowers (Woolwich Polytechnic, S.E.), W. A. Nicholls (Plumstead, S.E.), *E. L. Oliver (Peckham, S.E.), and *E. R. Phillips (Bermondsey, S.E.).

* Indicates sitting member.

WITH OUR CHILDREN.

Where Doctors do *not* disagree.

WHEN one has made a statement, it is always pleasing to find that in the main that statement is true; for, unfortunately, the intention of confining oneself to the truth is not always easy to carry out. This remark is made *à propos* of certain statements which I felt constrained to make in this column, some little time ago, on the subject of children's sleep. I have since discussed the subject with various competent authorities, including a physician of wide experience, and am convinced that my statements regarding the fact of children's sleep being often insufficient in amount, and regarding the physical and intellectual results of this deficiency, might safely have been made a good deal stronger.

A master in a large endowed school, otherwise unknown to me, has been good enough to write on the same subject, referring to the practical value of the hints I then threw out, and indicating his intention of making some investigations on his own account. This is eminently satisfactory. *O si sic plures!* Unless the notes which may be made under this heading are useful in suggesting individual action by teachers, the space had better be devoted to something else. Any direct evidence of their utility will be highly esteemed by the writer.

A lecture on the "Physiology of Rest," by Dr. Noel Paton, a well-known specialist in Edinburgh, has further emphasised the value of sleep to the young. A point the layman is apt to overlook is that during sleep the whole system is not inactive. The alimentary processes, for example, continue. It is really a period of storing up energy to be expended during the activities of waking life. In the latter period, waste exceeds repair; in the hours of sleep, repair exceeds waste. Add the necessities of growth to those of waste in the young, and the practical value of abundant sleep in their case is evident, more especially when we consider that the child is practically never at rest unless when asleep, while the adult will make shift to maintain a fairly complete inactivity now and then during waking hours.

A Useful Demonstration.

It is now some time since Dr. Francis Warner, the well-known specialist in the treatment of nervous children, gave a practical demonstration in the methods of diagnosing certain types of nervousness in school children; but the value of his demonstration seems to demand that, even at this late period, some notice should be taken of it in this column. Through the kindness of Mr. T. G. Tibbey, B.A., Honorary Press Secretary to the London Branch of the B.C.S.A., I am enabled to describe Dr. Warner's methods. The demonstration was given at the Home and Colonial Training College, at a meeting held in connection with the London Branch of the British Child-Study Association.

"As each group was admitted, the children were arranged in a line. Dr. Warner then passed along, holding a bright object, the movements of which the children were asked to follow. Those who in so doing kept their eyes fixed whilst

they moved their heads were put back. The remainder were then asked to hold out their hands, and some who held these in certain characteristic positions were also put back. A third time Dr. Warner passed along the line, and put aside any who showed any marked modification in the shape of the head.

"Finally the teacher was asked to select any of those yet left whom she would wish to have examined. In this manner, from the eighty children examined, thirty-six were selected for further consideration—seventeen boys and nineteen girls.

"These were then taken individually by Dr. Warner: again they watched the movements of a bright object, and again they held out their hands. Sometimes, also, they were told to raise one hand in time with the other, which was lifted by the doctor: almost invariably they moved the hand faster—the result of their physical exercises. Or, with eyes closed, they were told to move the fingers of one hand in the same manner as Dr. Warner moved those of the other: the vertical movements were well done, the lateral hardly ever. Their state of nutrition was also judged from the fullness of the limbs, the colour of the face and lips, and any signs of 'puffiness' under the eyes. For each child was reserved a card, upon which were noted the particulars observed, to be afterwards compared with the teachers' opinions, previously written out.

"At the close, Dr. Warner, in reply to questions, explained the significance of the various points noted, insisting upon the importance of training children to move their eyes, and the value to the teacher of some method by which, with fair accuracy and rapidity, he can judge the nervous condition of the child, and note the signs of fatigue."

This kind of demonstration must surely be recognised by every thoughtful teacher as of the utmost value. When one thinks of all that "nervousness" implies in a growing boy or girl, it seems imperative that teachers should be able to diagnose it in its simpler forms, and to recognise cases in which expert assistance is desirable. Now that the official Code no longer insists on a class advancing with perfect "dressing" (in the military sense), there is a chance for securing that school life may be made tolerable for even the exceptional pupils—but the teacher must be able to identify them. An arithmetic or a dictation test does not tell all that it is necessary to know about a pupil's state. Perhaps we may come to recognise that knowledge regarding such physical aspects of the pupil is as valuable to the teacher as the points of school hygiene which already appear in certain examination papers, such as the knowledge of common epidemics and the treatment of a bleeding nose.

The School and the World.

The World and the Church form the more common antithesis, but the World and the School are apt to become rather loosely related, if not quite antagonistic. Doubtless we study the world in its geographical and scientific aspects, but the pupil who leaves school has to consider it, first and foremost, as a place to earn a living in. How much does he or she learn of this aspect of the world while at school? For boys and girls who begin work immediately on their leaving, the question may not be unworthy of a little study. There are other "surroundings" to the school than those taken account of by geology, botany, and the various natural sciences.

Miss S. Young of the Home and Colonial Training College has recently made some study of the ideas on such matters possessed by girls of eleven to fourteen years of age. The results of her *enquête* seem to indicate that such ideas as they have formed are not due to any influences received at school, but depend on other influences, such as home circumstances and accidents of locality. This is, of course, natural, and was no doubt what Miss Young anticipated. The precise ratio of popularity between domestic service, dressmaking, teaching, typewriting, and the rest is a matter of little consequence; nor is it important to know in what degree choice of future occupation was determined by remuneration, leisure time, respectability, and other factors.

The more general aspect of this question seems the more suggestive, and that is, how far teachers can and ought to give their older pupils information which might be of some service in leading to a wise choice of their future occupation. Authorised offices for the information of intending emigrants to our colonies are now also recognised as desirable and necessary for the guidance of the adults who are seeking a new sphere of activity. Do we not seem to need an "emigrants' inquiry office" in school for those about to emigrate to the world beyond it? Or should we leave all this to the home and to the world itself? It does not seem as if all the arguments were on one side in this question.

A Study of Fear.

The Press Secretary of the Cheltenham Branch, B.C.S.A., has kindly forwarded some notes of a lecture delivered there by Mr. T. G. Tibbey, B.A., on "Children's Fears." The lecture was based on the answers given by 1,300 children in Board schools in London to the request, "Write about anything of which you have been afraid." There is a commendable vagueness about this request. To ask a boy what he has been *most* afraid of, or, still more, what he *is* most afraid of, would be to make too great a demand on him. A study of fear must always be a study based on reminiscence, and the lecturer did well to add to his *data* the replies of 150 older persons to the same query. No one cares to confess to present fear of anything, unless he or she is pretty sure that the fear is really groundless—a kind of fictitious or ornamental fear. At the same time, people will quite readily confess to past fear of things which they have since learned to be quite harmless.

Again, there are fears which may be described as having an æsthetic quality; one likes now and then to have the thrill of a fictitious terror. Hence the popularity of ghost stories, of thrilling adventures where we share in a mild form the perils of the hero, and of the nursery tales where Bluebeard or the Wolf can be depended on to show his wonted ferocity. I am not sure but that such fears are apt to be longest remembered, and to be most readily mentioned when we are put to the question. Hence, no doubt, the comparative frequency of mention of terrifying stories in the papers of some children, and of the fiercer denizens of the Zoo in those of others. And I am not sure that I quite agree with what seems to have been the conclusion at the Cheltenham meeting—that such stories or pictures as may excite the emotion of fear should be *tabu* in education. That there may be abuse in this line all will at once agree. That imaginary or supernatural terrors should be used to deter young children from juvenile failings when no one is by, is simply diabolical. But human nature loves a thrill of the excitement that is akin to fear, and a good rampant Bluebeard who meets his deserts in the last chapter is a personage for whom I must confess to feeling a hidden admiration. Doubtless this is very wrong. One ought to be ashamed, in this young century, to admire a real old-fashioned villain; yet some people still prefer to have the villain of the novel distinguishable from the other characters—a distinction which it is becoming increasingly difficult for the reader to make as time and books flow on.

Speaking of children's fears, is it at all common for a boy to be most afraid of *being afraid*? I have known such a case. The boy was of a nervous temperament, but not cowardly; he faced his boyish perils with the others, and without more than his fair share of caution. But he was haunted on many an expedition, more or less unlawful, with the fear that he *would be afraid*. I cannot learn that this fear was realised at any time, though there were occasions in his experience when it might fairly have been so. Nor can I say at what period he outgrew this feeling, if he ever did. Possibly there may even be soldiers of mature years whose chief fear is not wounds or death, but the fear lest they should be afraid—*feel* afraid, that is, not *show* fear or run away, which I suppose no one ever contemplates as a possibility. I merely mention the case as interesting, and as an example of a somewhat complex mental state in a very young boy. Perhaps it may awaken reminiscences in some reader of these notes. J. G.

TECHNICAL AND SECONDARY EDUCATION.

THE WINTER EDUCATIONAL CONFERENCES.

It cannot be said that teachers are indifferent to their own interests, or to the welfare of education, if meetings in conference are any test. During the Christmas vacation the Head-Masters' Conference, the Federation of Head Teachers, the Incorporated Association of Head-Masters, the Assistant-Masters' Association, the Teachers' Guild, the Modern Languages Association, the Educational Institute of Scotland, and meetings of science teachers organised by the London Technical Education Board, have been held. Their discussions have ranged over a wide field. Professional matters have not been neglected, the politics of education have been widely discussed, and school organisation and methods have been freely handled. If only the public could be stirred in a similar way, there would be hope for educational progress. Some approach to a common ground of action appears to have been mac'e by the various sections of secondary school teachers, but much more give-and-take will be needed before it is possible for the National Education Council to have any weight with the public.

The Head-Masters' Conference. Some thirty-five head-masters and thirty-five assistant-masters attended this Conference at Bradfield College, under the chairmanship of Dr. Gray. It is just possible there may be some good reasons for the existence of this as a separate association, but not any of weight present themselves to us. The Conference expressed itself in a dozen resolutions during the two days of its continuance. The following were among the subjects discussed:—The register of teachers, respecting which it was agreed that there should first be a survey and a register of secondary schools—that candidates should be graduates, or have a diploma equivalent to a pass degree, have followed a course of training, and give proof of two years' efficient service in an approved school; the need of uniformity in the standard required for various examinations; the education of officers for the army; and the teaching of modern languages.

The Incorporated Association of Head-Masters. The Incorporated Association of Head-Masters is a much larger association than the Head-Masters' Conference, and is officered by two energetic secretaries, Mr. Swallow and Dr. Scott. Dr. Gow of the Nottingham High School is this year's president, and he devoted his opening address to the consideration of the Higher Elementary Schools Minute, and accepted it as carrying out in a great measure the views expressed in the concordat between the Incorporated Association of Head-Masters and the Association of Higher-Grade School Teachers. He also referred to the paucity of men teachers and their inferior quality, and to the continuous and steady growth of the number of women teachers, who he supposed would ultimately be admitted into grammar and endowed schools for boys. Lack of promotion and prospects were the two factors responsible for the scarcity of men teachers.

Resolutions were submitted desiring the establishment of local educational authorities responsible to the Board of Education for the local control of secondary education as of the utmost importance. They welcomed the Lord President's Bill of the session of 1900, because it recognised that the local authorities were to be established by scheme; that the county councils and county borough councils were to be the nucleus of these authorities; that they should include experts, and be responsible for secondary education; and that there should be one rating authority in a school district.

The report of the Association pointed out that a large number of the grammar schools of the country, for the sake of earning grants, had become organised science schools. The minimum time for science, however, ought to be reduced in the first and second years' courses, and the time for literary and language subjects should be increased. The minimum number of pupils necessary to permit the establishment of a science school should be fifteen, and schools should be permitted to earn the higher grants paid for advanced students of the third and fourth year of the course submitted by the head-master for inspection and examination. Resolutions embodying these suggestions were adopted, as was also one declaring the necessity that more attention should be paid to the teaching of the mother tongue, especially in the direction of literature, as distinguished from grammar and composition. To compel conductors of elementary schools to send promising children earlier to secondary schools, and to prevent their continued attendance in higher-grade schools, a resolution was passed declaring the undesirability of granting Oxford and Cambridge certificates to any candidate who fails to pass in one language other than English. The Higher-Grade School Association had written protesting against the attitude of the Incorporated Association of Head-Masters towards the Higher Elementary Schools Minute, inasmuch as it contravened the agreement arrived at in the concordat; but notwithstanding this protest, a resolution was passed approving of the Minute. The question of tenure gave rise to a long discussion. The views of the head teachers may be summarised thus:—Assistants should receive at least a term's notice, to be given not less than seven days before the beginning of a term; head teachers should have the sole power of appointing and dismissing assistant teachers; any one dismissed for wrongdoing should have no appeal except to the law courts, but those dismissed for other reasons might present their case against dismissal to the governors within six months, and an official inquiry should be made by the Board of Education.

The Assistant Masters' Association. This Association met at Christ's Hospital. It now includes some sixteen hundred of those employed in secondary schools, or about 40 per cent. of the total number employed. The report declared that no great improvement could take place in their condition unless the Association numbered within its ranks four thousand. "Tenure" is one of the chief subjects which affects them. They find it difficult to proceed without money, and consequently, although the Grantham judgment by the Charity Commissioners recognises the necessity for a term's notice, and an appeal, if desired, to the governors, the practice is by no means universal, nor is the judgment binding. The annual conference was chiefly remarkable for a strong speech by Mr. Page of the Charterhouse School, declaring that no scheme for the organisation of secondary education can be satisfactory in which provision is not made for obtaining and carrying out the views of assistant teachers. This points to the fact that, while head teachers' voices are heard on the Consultative Committee of the Board of Education, those of assistant teachers have been entirely ignored. Evidence was given that the assistants are waking up to the necessity for combination in their own interests, but a considerable advance must be made before a united front can be presented by assistants and heads together. While primary teachers, with greatly diverging interests, combined together in one body for general educational interests, and afterwards formed sectional associations, secondary teachers have as yet no common platform, and no *rapprochement* at present seems possible.

The Views of Science Teachers. Under the auspices of the London Technical Education Board, for the third year in succession, a meeting of science teachers, extending over two days, was held in the South-Western Polytechnic, some three hundred and fifty teachers having applied for admission. Papers dealing with the making of scientific apparatus for schools, the co-ordination of workshop and laboratory practice, and the fitting up of electrical, chemical, and physical laboratories, were read during the first day. Professor Armstrong strongly urged upon teachers the necessity of simplification of apparatus and language, that laboratory should give place to workshop, and declared that students were being spoiled by being over-provided for. He said that no learning was of any use which could not be put to some use; and that Rudyard Kipling would confer a benefit on the State by writing a poem with the refrain "Weigh, weigh, weigh," for use during science lessons of all sorts. Professor Earl Barnes was present, and gave an address, entitled "Nature Teaching for Young Children." He advocated the regular introduction of live things into the schoolroom for

use in object lessons. A paper on "Psychology and Science Teaching" concluded the series of discussions.

The Teachers' Guild. The eleventh annual conference was held this year at Brighton, under the presidency of the Rev. Canon Lyttelton. Like the other bodies engaged principally in secondary teaching, the Guild is in favour of the municipalisation of education, the authority being exercised by a statutory committee containing experts. It was with the view of encouraging the Government to proceed upon these lines that the chairman introduced the subject. The Bill of 1900 would seem to satisfy the desires of the Guild, resolutions on the lines indicated being passed. The teachers of private schools do not wish to share the fate of those who had private adventure schools before the passing of the Education Act of 1870; for the president of the Association of Private Schoolmasters moved a resolution in favour of private schools, efficient and properly managed, forming a part of the recognised provision for secondary education in the country, their interests being safeguarded by Parliament. Opposition to free places in secondary schools was expressed, and a resolution against scholarships which included maintenance was carried. If this policy is pursued, it means that many of those who now obtain scholarships and proceed to higher studies will in future be excluded from secondary schools, which will become class institutions pure and simple.

The Views of Organising Secretaries for Technical Instruction. The tenth annual meeting of the Association of Organising Secretaries for Technical and Secondary Education was held in the Guildhall, Westminster, on January 11. As in the other bodies, the organisation of secondary education and the Cockerton judgment came in for a great deal of comment. Referring to the powers of rating, a resolution was passed declaring it imperative that the rating powers for secondary education should be placed in the hands of one and the same local authority, which should be the county or county borough council. The mover of the resolution, whose antipathy to School Boards is proverbial, declared that their work was not to promote education, but to do a sort of educational dirty work—to act as a supplement to our police system. School Boards were an excrescence on our municipal arrangements, and recognition of that fact was essential to good legislation.

The Present Position. Judging from a broad view of the meetings just held, it appears that the antagonism to School Boards and their work is rife as ever among those engaged in secondary work. Rejoicings were almost universal at the Cockerton judgment. School Boards were declared to have had their day, and ought to be superseded by a municipal authority aided by experts. Every effort seems to be made to secure for secondary schools as much money as possible from local and imperial taxation, and the whole of the funds at the disposal of the community for technical and scientific purposes is to be appropriated to the education of those who can afford to pay the fees of secondary schools. General approval of the lines of the Devonshire Bill of 1900 was manifested; while little desire was expressed that the new educational authority should have control of primary as well as secondary education. It is, however, only on this latter consideration that it will ever be possible to properly graduate and co-ordinate the various educational agencies at work, or give due attention to the requirements of nine-tenths of the population of the country. The salvation of the people's part in education depends upon due consideration being given to the views of School Boards, whose work during the past thirty years has entirely changed the position of this country in the scale of nations in reference to provision for education.

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THE EDUCATIONAL INSTITUTE OF SCOTLAND CONGRESS.

BY OUR OWN CORRESPONDENT.

Some time ago we had hopes of going as far north as Inverness to visit Congress, and of sharing in the right Highland welcome we should have been sure to get; but the tragic death of Major Mackenzie, President-elect of the Institute, shattered these hopes, and compelled our northern friends to give up the idea of holding the Congress there at this time. The president for the year, however, is a "Thrums" teacher, and it is only natural that the place chosen for Congress should be the most important centre in his district.

The last occasion on which Congress visited Dundee was in 1887, so that it cannot be said, if we judge from the importance and vigour of its association, that Juteopolis has had more than its share of congresses. The very successful Congress held there at that time led us to anticipate an equally successful one on the present occasion; and from the programme put into our hands, it was evident that the local committee had worked like Trojans.

As most of our readers are aware, delegates are appointed to constitute the September meeting in Edinburgh; but the

ALEX. MENZIES, F.E.I.S., J.P.,
President E.I.S.

Congress, which is specially designed to educate public opinion on matters educational and professional, is open to all members of the Institute and to the general public. Its success is very largely contingent on weather conditions, and Dundee was peculiarly fortunate in having at least dry, though somewhat cloudy, weather on its opening day, January 2. As a result, there was a very good audience, which entirely filled the somewhat small and dingy-looking hall in which Congress was held.

A little after eleven o'clock, the president, Mr. Alexander Menzies, Kirriemuir, wearing his robe and chain of office, takes the chair, and is followed by Lord Provost Hunter; Sir John Leng, M.P.; Mr. J. A. Campbell, M.P.; ex-Bailie Macdonald, member of Dundee School Board; Dr. Mackay, treasurer of E.I.S.; Mr. John Laurence, secretary; Dr. Dickie; Mr. R. Calder, H.M.I.S.; Mr. J. T. Blacker, vice-president N.U.T.; Mr. J. J. Cullum of N.U.T.; Mr. M. Doyle and Mr. R. Patterson, I.N.T.O.; Mr. J. Knox, president, and Mr. J. Mudie, secretary, Dundee Branch.

The first part of the proceedings takes the form of a reception by patrons. Mr. John Knox, who, it may be mentioned, was among the last of those teachers who had to take the oath of fealty to the Queen, and to renounce the Stuart Dynasty, before being allowed to teach, introduces the various public bodies to the president. The Lord Provost, on behalf of the city and Corporation, extends a cordial welcome to the Congress, and expresses the hope that, during the time the Educational Institute is to be in Dundee, many

matters of the highest importance in connection with education will be thoroughly discussed. The Rev. Dr. Cox conveys the hearty greetings and warm good wishes of the Governors and Council of the University College for the success of the Congress and the increasing usefulness of the Institute. Ex-Bailie Macdonald, the oldest member of the Institute, welcomes them on behalf of the Dundee School Board, and assures Congress that from the beginning the Board has taken a very deep interest in the Institute's work. The president, in the name of the Institute, thanks the various representatives for their presence and their greetings, incidentally mentioning that the last Congress at Dundee had the official recognition of Lord Provost Hunter, and expressing the hope that this happy coincidence may be an omen of equal success.

The president then proceeds to deliver his opening address, on the subject of

Recent Educational Changes.

In looking back, he thinks it will be admitted that when the change came twenty-eight years ago, either the country was unprepared for it, or the men who could wisely work and direct the new machinery were wanting. Our legislation and administration in connection with Scottish education have been nothing more than tentative, and we are now about as far as ever from that complete and homogeneous system of national education which we have been so long looking for. Funds are not lacking, but in consequence of the diversity in the administration of them there is great confusion and haphazardness in their application. To prevent this overlapping and waste, he would have the control and direction of national education, both primary and secondary, and the administration of all funds destined for its support, entrusted to one responsible body composed of men of education and administrative capacity, and fully acquainted with the wants of their district.

The country is ripe for such a change, and public opinion is in favour of it, he thinks, while Congress shows in an unmistakable manner that it is of the same opinion. What is wanted is a statesman of enlightened, constructive skill, who from the chaotic mass of materials lying ready to hand will undertake to rear for Scotland a noble structure of national education, harmonious and beautiful in all its parts, and providing for the education of the people from the infant school up to the university. He looks to Lord Balfour, who, in his recent Bill, has shown that he thoroughly grasps the question of higher education. He would not have the new Bill confined to higher education; he would make it embrace primary education as well, and make the county the area of administration.

He then passes from the necessity of, and the field for, higher education to the consideration of what it should consist of. Over this subject we find various combatants engaged. There were the advocates of classical *versus* modern languages, and their opponents; the advocates of scientific and technical education, and their opponents; and, lastly, the advocates of a specially commercial education, with a considerable sprinkling of faddists of every sort. He thinks, however, that teachers are not called upon to take part in the strife. Their aim is the preparation of the scholar through all stages of his school career, so that, when he reaches the proper point, he may be ready to pass out to employment, or to pass on, with the least difficulty to himself, from the primary to the secondary school, and from the secondary to the university. For this purpose, he is of opinion that we at present possess all the necessary educational means and appliances.

After dealing with the subject of commercial education, to which he maintains the teachers of the present day are giving sufficient attention, and the questions of the teaching of modern languages and leaving certificates and examinations, he proceeds to the important subject of school-leaving age.

In answer to all the complaints that children were not being so well educated now as in the pre-School-Board period, he advocates that the minimum age at which pupils could leave school should be fourteen. The necessity for such a step is acknowledged on all hands by educationists, but legislators have not yet had the courage to grapple with the question; they temporise with it, they have recourse to this and to that device—such as the Labour Certificate, the Merit Certificate, and evening schools—but these are nothing but poor makeshifts for what is really needed.

The president then proceeds to advocate one or two Code changes. Education has been carried on along wrong lines for the last twenty-eight years. For long it was neglected; and ever since it was taken up by the State, people seem to have thought that they could not get quantity or variety enough of it in the shortest possible time for their money. By the recent Code teachers had more room and freedom than they used to have; and if they could keep the children long enough, they might hope to show that the nation's money was not spent wastefully on education.

The evil influences of the Low Code still survive, and so long as graded payments exist he maintains we have payment by results. Education and the educator cannot be free until the amount of Government grant depends on population, the wants of the district, and the provision made otherwise in localities for education, whether secondary or primary.

In conclusion, Mr. Menzies refers to the serious falling off in the

Supply of Male Teachers.

Some inquiry will require to be made as to how this has come about, and what the remedy is. It will involve many considerations, such as the reorganisation of the training colleges, the better payment of assistant teachers, a reasonable security against capricious dismissal, and a retiring allowance bearing a reasonable proportion to the actual salary at retirement. These points gained, there would be no reason why the teaching profession should not be as attractive as ever to young men of ability.

In the course of his address he does not touch frequently on professional questions, but when he does so, the audience readily show that he is voicing their opinions.

In a word Mr. Knox moves a vote of thanks to the president for his exhaustive address. The slightly controversial tone of it he hopes will continue throughout the Congress.

To Mr. I. Julius Weinberg, president of the Dundee Branch of the Royal Scottish Geographical Society, and a successful jute merchant, is entrusted the subject of

Commercial Education.

Speaking from a fifty years' experience as an export merchant, he says that real commercial education begins after an apprentice has entered the office, and what is wanted in school and college is that particular attention should be devoted to those subjects which are most requisite in business. Most schools make the mistake of aiming at too much, instead of concentrating their attention upon a few essential subjects and teaching these thoroughly. All nations are now nations of shopkeepers, and when a new country is opened the rush is to open the first shop. He advocates the decimal system, and thinks that arithmetic should not be taught for "home consumption." Boys should be taught to know the currencies of the different countries of Europe. Mathematics, he thinks, should be given, as it teaches "to think straight." Geography, especially commercial geography, is necessary and desirable. In this connection he says that his chief book-keeper had told him recently that he had been kept five years at the map of Africa. In history, he thinks the Victorian age the period most necessary to be studied. With regard to the study of modern languages, he advocates German, French, and Spanish. Spanish he finds to be of greater importance than French, inasmuch as much of his trade is with South America.

Too much time should not be devoted to the study of German and French classical poets, for it should be remembered that there is not much poetry in business.

He does not think that foreign clerks are employed in this country because they are cheaper. He pays more to his foreign clerks because they are better educated; they can write a better constructed letter, and spell correctly.

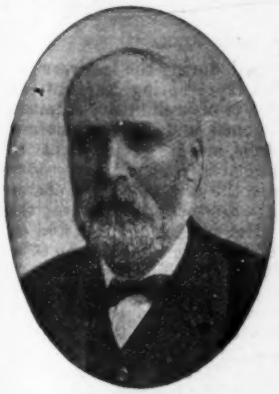
If the study of commercial education is to become prevalent, the initiative will have to come "from above"—from

the Scotch Education Department. The want of funds at present seriously handicaps the movement.

Throughout his address he frequently comes into conflict with the president's paper. Mr. Menzies, with that traditional love of the Scottish schoolmaster for classical education, thinks that our present method is the best; and Mr. J. G. Thomson, ex-president, in moving a vote of thanks to Mr. Weinberg, points out that if our national life depends on professional education, by all means let us have any amount of Latin and Greek; but seeing that it depends more upon our commerce and on our trade and the development of our industries, we must attend specially at school to those matters that will develop our national life. He thinks, however, there is no use of our talking of founding and equipping a commercial university so long as we have not the rudiments of commercial training founded in our schools.

JOHN KNOX, F.E.I.S.,
President.

Dr. Mackay endorses Mr. Thomson's sentiments, and points out that the Institute is taking up the question of commercial examinations and the issue of certificates. He moves: "That the E.I.S., recognising the great value of sound commercial education, is prepared to establish commercial examinations, and grant certificates to persons properly qualified for commercial pursuits." This is unanimously agreed to by the meeting, and it is to be hoped that the Institute will not delay in the matter.



J. MUDIE, F.E.I.S.,
Secretary.

Compulsory School Age.

Mr. J. Lamb, Dundee, moves: "That this Congress is strongly of opinion that it should be compulsory for all children to attend school until they gain a Merit Certificate or attain the age of fourteen." From statistics he shows that practically two-thirds of the children enrolled in our schools leave before passing Standard VI. The half-time labour system is evil and only evil, but he particularly condemns the employment of boys and girls from the ages of ten to fourteen as shop messengers. These children are in many cases worse off than the poor half-timer, and their treatment in regard to hours of labour is a downright disgrace to civilisation. We find these boys and girls on the streets at all hours of the day and night. As one who has taken a great interest in the question of the half-timer, Mr. Lamb speaks with great authority. So far as Scotland is concerned, the evil is confined to Forfarshire for the most part, and it is therefore well that the Institute should give some indication of its opinion in the matter.

J. GIBSON, F.E.I.S.,
Convener, Papers Committee.

Mr. Wilson, H.M. Factory Inspector for Dundee district, in seconding the resolution, mentions the results of his investigations into the physical aspect of the half-time system. Comparatively few of the half-time youths in Dundee have the necessary height and weight for enlistment in the army; while two-thirds are refused for volunteer regiments. His experience was that the great mass of parents who are sending their younger children to work have good wages themselves, and have sometimes the elder children bringing in wages as well. No scheme which has for its object an improvement in the condition, physical or mental, of the workers of their country, can, he thinks, be economically unsound.

Mr. Forbes, Springfield, Fife, wishes the reference to the Merit Certificate in the motion to be dropped, and the age-limit only retained. Mr. M'Callum, Glasgow, seconds. This, after a division, is adopted. In a good speech, Mr. Beattie, Oban, proposes another motion: "This Congress condemns the casual employment of children in the early mornings and late evenings." After some discussion, this also is agreed to. With this the somewhat protracted sederunt closes. The papers have, if anything, been too long, and the discussion too limited.

AFTERNOON.

The Congress assembles somewhat slowly in the afternoon, so that it is close on three o'clock ere the president takes the chair. To the Rev. D. B. Cameron, Chairman of the Dundee School Board, has been given the subject of

The Training of Teachers.

After observing that the success of the old parochial schools was due to the fact that the teacher had an absolutely free hand, he expresses the hope that the salary and status of teachers will improve, but on one condition—that the universities will take a more prominent part in their training. He advocates a return to the old system of university instruction, so amply justified in the past, with its curriculum revised and better adjusted to the needs of the century. He counsels a reconsideration of the present system of pupil-teacherships. The imparting of knowledge should be preceded by careful study of child-life, based on observation and reflection. The instruction to the individual mind, the skill, patience, and kindness required in the discipline of classes, and the moral control, which means so much, could not be expected from teachers of fourteen or sixteen years of age.

J. FERGUSON, F.E.I.S.,
Treasurer.

He proposes that after a boy or girl has succeeded in passing the preliminary examination or in taking the Leaving Certificate, a whole year should be devoted to the work of practical training. At that time they will have reached the age of seventeen, and they can become Queen's students at the age of eighteen. Then they will be in a position to become efficient in the art of their profession, and have something to impart to their pupils.

On the motion of Dr. Dickie, Congress accords a hearty vote of thanks to the lecturer. He takes exception to Mr. Cameron's view that the teachers do not belong to the learned profession, and hopes that in the future they will be the only learned profession. People, he hopes, will then be too good to need a clergyman, too wise to call in a lawyer, and too healthy in body and mind to need a physician. Congress thoroughly enjoys this hit. He points out that the Institute is at present considering the question of the training of teachers, and is of opinion that teachers begin too young at fourteen, and that they should be trained at the university and also in their best schools.

The president then calls on Miss Frances Melville, Warden of University Hall, St. Andrews, to give her paper on

Women and Research.

The title, she admits, is somewhat misleading; but for lack of a better, she prefers it. She deals with the general lack of interest shown by women as yet in the spirit of research. She does not restrict the word "research" to scientific research, but includes in it the prosecution of some study on one's own account, either in a university or collegiate career—some study that tends to call out and exercise the higher intellectual faculties.

Research should go hand in hand with the practice of education, and the education of the country is to a large extent in the hands of women. The educator who lacks the student's spirit of research is like a man who lives on his capital, and it leads to an analogous bankruptcy. This want of spirit is by some attributed to the lack of time. In America furlough was granted to teachers for the furtherance of private study.

Mrs. Carlaw Martin, member of Dundee School Board, conveys the thanks of Congress, and pays a high tribute to the lofty ideals laid down by Miss Melville.

Superannuation and Tenure.

Mr. Blackstock, the Scottish Apostle of Superannuation, next addresses Congress on this subject. He thinks it a public scandal that a teacher, after forty-four years of work, should be made to retire and "live on coals, water, and gas," which, he understands, is all they can get for £40 a year.

Seventy-one Scottish members of Parliament are pledged to the resolution he proposes—namely, "That the Treasury allowance granted to existing teachers under the Elementary School (Superannuation) Act, 1899, be increased to such an extent that the benefit to be received by them will equal that given under the Act to future teachers." This is the question of urgency in connection with superannuation. Mr. Blackstock waxes eloquent on this subject, and though there are other points requiring attention, he is willing to postpone these till this is secured.

Mr. Laurence, in a very neat and effective speech, seconds the motion. Mr. Rae, Wamphray, evokes considerable laughter by declaring that if the existing teachers are thrown upon the country at the age of sixty-five with nothing but the miserable allowance granted by Government, they will not be "existing teachers" long. Mr. Martin, Edinburgh, deprecates the question being treated of as "one of bread and butter," and he thinks it is not right for teachers to go to Government with hat in hand. He wishes the matter rather to be decided on the broad principle of justice. In this matter we agree with Mr. Martin; the question has been too often discussed as "one of bread and butter."

Mr. Duthie, Aberdeen, the stalwart, who, as he says, carries his platform with him, moves: "That in the interests of education it is desirable that steps should be taken to secure teachers against arbitrary or capricious dismissal." He maintains that the principle on which teachers hold their position is quite satisfactory, but that the application of the principle has been frequently wrong. Many teachers dare not speak out on certain matters, and cannot do their duty conscientiously, because they cannot run the chance of losing their situations. Mr. Martin seconds, and the motion is carried by acclamation.

Foreign Delegates.

Again we should like to say that we do not think the delegates from the English and Irish associations should be asked to address Congress at the fag-end of a rather protracted sederunt. It is hardly courteous, to say the least of it.

The N.U.T. this year is represented by Mr. J. F. Blacker, vice-president, and Mr. J. J. Cullum; and the I.N.T.O. by Mr. M. Doyle and Mr. R. Patterson.

Mr. Blacker, in referring to Mr. Blackstock's speech on Superannuation, says that the Executive of the N.U.T. were equally anxious with the E.I.S. to get the best terms at the time, and he expresses the hope that the Scottish teachers will help them also in the future. He conveys to Congress the fraternal greetings of the 45,000 members of the N.U.T. The teacher, he maintains, always puts the child in the premier position, but he cannot work miracles, and can do very little until the first step is made in social progress. He next gives us his experience with regard to dismissal cases he has had to fight. Of all the local authorities, the abomination of educational desolation is the five-membered School Board. He rejoices in the success of the Institute, and hopes that it will increase by leaps and bounds.

Mr. M. Doyle, Ballymote, in name of the Irish National Teachers' Organisation, conveys their generous greetings to the Institute. They are at present waging war, he says, with regard to the managerial question and security of tenure. He rouses the Congress to the heartiest outburst of sympathy for the Irish teachers by the tale of "grievances," by no means exaggerated, which he recounts. It might have been well if Congress had been asked to pass a special vote of sympathy with the Irish teachers.

Mr. Reoch, in name of the Institute, reciprocates the kind greetings.

SECOND DAY'S CONGRESS.

There is a very good audience when Congress resumes, the weather being again very fine. Professor M'Cormick, University College, Dundee, opens the second day's proceedings with an address on

Examinations and Cram.

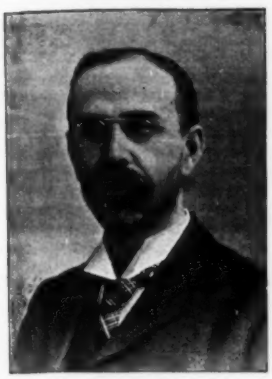
The professor has been engaged during the last year and a half, along with two colleagues representing England and Ireland, in investigating the subject of preliminary examinations of the General Medical Council, and speaks, therefore, with authority. Every point tells, and it is evident that he has the sympathy of his audience.

The criticisms of the teacher on the examiner are probably as important, he thinks, as the examiner's criticism of the teacher; for the examiner is, after all, but a critic, and an inferior sort of person compared with the teacher, who is, or at least ought to be, the creator of the thing the examiner merely criticises. The diversity of opinion, given the subjects, of what a good school education should be has struck him very forcibly. He is astonished that so little attention has been paid to the best methods of testing that education, and the result of that neglect is that examinations have fallen into disrepute amongst those who have true education at heart. He asks if examination is in its essence evil. The true examiner must meet the true teacher, and the examiner and teacher must have an accepted ideal of what education means; and when each criticises the other, he must be criticising himself and his own ideal. A teacher has a right to express his opinion on the nature of the questions asked.

He deprecates asking a full list of the exceptions to a rule in languages, and dates in history. A certain amount of cram, he admits, is necessary. Spelling, the multiplication table, declensions, and paradigms of verbs are pretty much pure memory work. In the teaching of foreign languages, the correct use of the English tongue is quite as important as the correct use of the foreign. He attributes much of the bad English composition to the foreign teacher. In prescribed work the crammer has the pull over the true teacher. As teachers, our function is not to prepare pupils on set work, but to prepare them for life, as they do not get set books when they come to deal with the emergencies of life. With regard to the question of the use of modern languages, he would only say that before these or any subject could claim equality in the preliminary examinations with other subjects, they must show that they were an equal test of mental training.

On the motion of Mr. A. H. Hutt, Broughty-Ferry, Congress accords to Professor M'Cormick a hearty vote of thanks. From his own experience, he thinks that most cramming is done at the universities. Dr. Mackay, in seconding, refers to the examinations carried out by the Institute. Dr. J. E. Parrott, Edinburgh, in supporting, says

It is a pleasure to meet an examiner who is also a teacher—indeed, a teacher first and an examiner afterwards. He has no sympathy with the examiner as such; he is an adventitious growth, and has become even more important than education itself. He has no hesitation in saying that the examiner is responsible for all the cram in the school. His idea of an examiner is not one who puts such questions as—"Who dragged whom how many times round the walls of what?" His idea of a real examination, which would bring out everything in the scholar and the best in the school, is for the examiner to put the teacher in front of his pupils to examine them. It should be the examiner's care to see that the teaching is absolutely sound and good, and not whether the pupils can answer his conundrums or not. Mr. Beattie, Oban, holds that the State, through its examinations for the ordinary branches of the Civil Service, is the worst offender in cramming.



J. LAMB, F.E.I.S., F.S.A.,
Handbook.

To Mr. G. K. Smith, Convener of the Evening Schools Committee of Dundee School Board, is entrusted the paper on

Evening Continuation Schools.

He gives Congress a short history of the evening-school movement in Dundee from its beginning, but he cannot be said in his paper to have added much information on the subject. He thinks, with regard to evening schools in general, that they should be supported, and that the ratepayers should look upon the money spent on them as a remunerative investment.

On the motion of Mr. J. F. MacDiarmid, Dundee, we accord our thanks, and Dr. Mackay, Edinburgh, moves: "That evening continuation schools should steadily aim at taking up the work of instruction where it is left off by the day-school pupils, who by their attainments have already satisfied the requirements of the law; and further, that, where necessary, separate schools should be set apart for backward pupils." In speaking to the motion, he declares that for every £1 spent, £2 or £3 will come back in the way of closing the doors of poorhouses and prisons. Mr. G. Duthie, Aberdeen, seeks to account for a considerable extent of the weakness of evening schools by the fact that they are conducted by teachers who are already exhausted by their ordinary work.

SECOND AFTERNOON.

Dr. Dickie, Kilmarnock, now reads a paper on

Secondary Education.

From his point of view the question was of the utmost importance at the present time, for the Bill on the subject which Lord Balfour had brought in last year would undoubtedly be reintroduced in one form or another. The greatest blots on last year's Bill were that it was of the order of piecemeal legislation, dealing partially, and in some cases unfairly, with various classes of schools, which, though doing the same secondary work, were separated by social distinctions; it savoured too much of class legislation, and that was always odious; it created a new body of managers, whose powers would conflict with those of many existing Boards.

MISS SMART,
Ladies' Committee.

During the last thirty years so many conflicting interests had sprung up, public opinion had so changed as to the relation of education to the State, and there were such glaring inequalities in the management and support of schools, that at the present time he thought, with a strong Government in power, with an able Chief-Secretary of exceptional experience, and a popular Scotch Education Department, there seemed to be an excellent opportunity of making the promised Bill include all grades and classes of education up to the universities.

J. MACDIARMID, F.E.I.S.,
Entertainments.

With this object in view, the first essential is to provide for larger School Board areas, both on the score of economy and efficiency. The opinion is growing that the time has now come when education, in all its branches, may be entrusted to the State, acting through county and town councils or large School Boards. Small School Boards have had their day, and done splendid service to education; but now that a good system of elementary education has been set agoing, the Board, in most cases, has become an unnecessary and expensive luxury.

Again, the public funds at the disposal of the Scotch Education Department are now very considerable. At present, with all the care exercised by the Department, it cannot be denied that there is considerable leakage, and overlapping of grants in aid. He would have the Bill provide for the consolidation of all public educational funds. It is not too much to expect that Scotland may be allowed now to return to that national system of education which was regarded as the birthright of the people, without consideration of class. There should be no more pandering to expediency, no more patching up of flaws in former acts and minutes of Council.

The Government should look at education as a whole, and on principles of economy and efficiency produce a system commensurate with the wants of the country, and suitable to the increasing requirements of the age.

Mr. Mudie in a word conveys to Dr. Dickie the best thanks of Congress for his most able and instructive paper.

On the motion of Mr. Henderson, Glasgow, Congress agrees, after a very little discussion, "That it is urgently necessary that all educational funds should be combined, and that all schools, whether secondary or primary, should be placed under the same management."

To Mr. C. M'Donald, Leith, ex-president of the Class Teachers' Association, is entrusted the paper on

Recent Educational Changes as affecting the Position of Class Teachers.

He contrasts the new system with the old *régime* abolished two years ago. Teachers on all hands have welcomed the new order as being based on sound educational principles and conceived in a liberal spirit, and thinks that on their part no efforts will be wanting to give it a fair trial. He then refers to some of the points which are open to criticism. He expresses regret that no steps have been taken to secure uniformity throughout the country for the examination for the Merit Certificate.

The manner of determining who are and who are not to be presented for that certificate is also unsatisfactory, and the way in which many School Boards insist that every scholar in a class shall be presented for the examination is at variance with the whole spirit of the Code.

He condemns the large classes at present being taught; he points out that the aspect of affairs has been so changed owing to the erection of large schools, that the training-college student of to-day has only one chance in five of ever rising above the rank of ordinary assistant. He advocates,

as a relief to the present state of matters, the creation of intermediate posts between the class teacher and the headmaster.

Mr. Blackwood, Dundee, voices the thanks of the Congress to Mr. M'Donald for his suggestive paper. Mr. G. Fenton, Aberdeen, in an able speech, moves: "That in order to secure better individual supervision of the pupils by the head-master, more perfect correlation of the work of the various grades, and the best educational results from the changes recently introduced, it was essential that heads of departments be appointed in large schools." This is seconded by Mr. A. Small, Glasgow.

This motion causes the first and only ruffle in the calm serenity which has pervaded the whole of the Congress proceedings. Mr. Mudie, Dundee, opposes the motion in a speech which he has not finished when the president rises to stop him. He, however, desires it to be known that he considers the motion out of order. Mr. Gibson, Dundee, also opposes it, since it has not appeared on the agenda paper. After some discussion, in which it appears that there is great uncertainty as to the method of procedure, the class teachers withdraw their motion, on the understanding that it is to find a prominent place in the next Congress.

Thereafter Dr. Mackay proposes the usual vote of thanks to the president and to the local committee.

On the whole, it may be said that the Congress has reached a good level. There is still, however, a great overloading of the proceedings with very long speeches, largely taken up with historical introductions, which as a rule extend to half the paper. Would it not be well to limit each sederunt to one paper, with discussion thereupon? Discussion and opposition were conspicuous by their absence. There were one or two able papers, but it can hardly be said that the Dundee Congress has brought forward any new leader in educational thought. The last few minutes of Congress conclusively proved the necessity of standing orders; at present there are none, and the president and the meeting are at the mercy of any who think they can bring forward any subject. It will be well in future if standing orders for Congress should be adopted. The attendance, on account of the length of the sederunts, is apt to be very thin in the afternoons, and it is a pity that such should be the case. Might we suggest the concentration of attention on two or three subjects only, instead of papers on the whole gamut of education, however varied and interesting that may be. One or two of the papers did not reach the level of Congress debates.

Of the

Adjuncts of the Congress

it may be said that all these were well patronised. The Dinner, with its spate of oratory—there being no fewer than eighteen toasts, and therefore thirty-six to forty speeches—showed that a Scottish audience was very long-suffering. Teachers, it is said, are men of large discourse, and so no opportunity of speech-making must be lost.

The ladies' "At Home" was very successful, and there, too, papers were the order of the afternoon. The class teachers' Breakfast was well patronised, while the Conversazione and Assembly were crowded with a gay and brilliant gathering.

The Local Committee, of whom Mr. Mudie, Mr. Gibson, Mr. Lamb, and Mr. MacDiarmid may be mentioned, are to be congratulated on the work they did. Everything was well done, the arrangements were excellent, and the visitors to Dundee were well catered for in every respect.

The Publishers' Exhibit was of the usual excellence, and was visited by a large number of teachers.

The Congress Handbook.

The handbook of the Congress—a very tasteful memento of the proceedings—was the gratuitous work of Messrs. Chambers, to whom the best thanks of Congress are due. We have to acknowledge their kindness in allowing us to use in this article some of the photos which appear in the handbook.

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ENGLAND'S PREPARATORY SCHOOLS.

VOL. VI. OF SPECIAL REPORTS ON EDUCATIONAL SUBJECTS.

What a Preparatory School is.—In most of the salubrious parts of England may be found private adventure boarding schools devoted to the work of preparing boys for entering the various public schools of the country, maybe with, but just as likely without, one of the entrance scholarships, of which some sixty are offered for competition each year. It is to a description of this part of the educational equipment of haphazard England, mainly from the pens of those who have toiled and moiled in these establishments, that Mr. Sadler has devoted his sixth book of Special Reports.

The Rise of the Preparatory School.—Mr. C. C. Cotterill, secretary of the Association of Head-Masters of Preparatory Schools, to whom Mr. Sadler ascribes the credit for most of the work that is represented in the five hundred odd pages of the Report, tells us that the founder of the preparatory school was a certain Lieutenant Malden, R.N., who, moved by "abhorrence of the harshness of discipline which frequently marred the splendid nobility and chivalry of nature characteristic of the British sailor in those and all other days," left the service in 1837, and,

> Thinking he was formed to rule,
> Set up for master of a school

for candidates for the Royal Navy, in the Isle of Wight, in the same year. But Dr. Arnold, with whom the worthy lieutenant was acquainted, had sounded the tocsin in 1828, when he admitted that public schools *were* the nurseries of vice, and, at the same time, expressed the opinion that one of the causes leading up to this alarming condition of affairs was the early age at which boys entered the public school; hence his advice that parents should not send their boys to a public school until they were at least twelve years of age. Out of this grew the demand for schools in which young boys might be trained for public school life, and the supply has in these days quite overtaken the demand, seeing that there are some four hundred of this type of school existing in England at the present time.

Commercial Speculators.—It is admitted that the whole of these schools are the products of the commercial enterprise of their proprietors, the Government of the country having no voice whatever in their management or control. However creditable this may be to the masters—most of whom are graduates (generally in honours) of Oxford and Cambridge—it is certainly eminently to the discredit of the educational authorities of this country that they should leave it entirely to chance whether a Squeers or an Arnold took in hand the work of developing the souls, minds, and bodies of such an important part of young England. The Report unhesitatingly declares that the vast majority of these schoolmaster-adventurers lean to Arnold much more than to Squeers, and that a Dotheboys Hall is nowhere to be found amongst the four hundred English preparatory schools; whereat we, in common with all well-wishers of education, rejoice greatly, whilst refusing, however, to acquit the various governments of much neglect.

Quis custodiet custodes?—The answer to this question is a double one. In the first place, preparatory schools, in respect to their curriculum, are held in fetters by the public school, which is another way of saying that, as a rule, they bow the knee to the Baal of classical lore. English, science, and modern languages have but small place in the school programmes of these schools. In the second place, the control is with the parents, whose good will is as the breath of the nostrils of the head-master of the preparatory school, for without their approval he cannot live. Even if he is, like Cæsar's wife, above suspicion, his numbers may fall off, and then woe betide the hapless wight; for he has embarked his all, amounting often to some thousands of pounds, in the venture, and he must look to it lest, like Othello, he find his occupation gone, and with it his capital. It speaks volumes for the enterprise of the master who finds himself in such bad

case, that he often emulates the Boers and treks to some more favourable locality, where he may ply with chalk and duster, whilst enjoying the hire which the labourer is in this case all the more worthy of because, English-like, he does not know when he is beaten. One cannot but admire the men who thus devote themselves (for a consideration, it is true) to this branch of English education.

What the Consideration is.—It is no easy matter to give exact figures with respect to the profit made by these schoolmasters of fortune. We have it, however, on the evidence of Mr. Cotterill, that "their incomes must vary from something more than £15,000 to something less than £150 a year, and their profits, from something that I cannot attempt to estimate to *nil*." He further states that, albeit some preparatory head-masters have retired on handsome fortunes, they are the exception; and he emphatically asserts that the majority think more of their schools than of their pockets, spending and being spent in their desire to do their part towards keeping up the quality of the race. This may be true, but there is a great temptation to pinch and makeshift in order to get a respectable emolument.

Start by getting deeply in Debt.—In further proof of his contention, Mr. Cotterill tells a story of a head-master two of whose assistants were about to set up in business for themselves, and who came to him for advice. Here is the sole recommendation that he had for them: "The first piece of advice and the last that I have to give you is, Start by getting deeply in debt." There may be a dash of the adventurer in this attempt to qualify for the bankruptcy court; but it strikes us as just as much out of place in the trainer of the young idea as gambling on the Stock Exchange or on the racecourse.

The Bearer of the Burden.—This is, of course, the assistant-master, who is likely to be happy as long as he can keep from thinking. Taking a well-equipped school as his exemplar, Mr. Cotterill gives the following facts: "It is a boarding school in the country, and accommodates about fifty boys. The resident teaching staff consists of the head-master and four assistants. Of these assistants, the senior master, who has possibly been at the school fifteen or twenty years, may receive £200 a year, with board and lodging; his junior colleague, perhaps from the university, about £120; and the two others about £150." But the worst feature of this most undesirable of careers is the absolute certainty that three-fourths of the victims thereof have to face a future in which it is impossible to marry and have a home. Moreover, like so many other workers, the assistant-master becomes too old at forty, so that to him the cynical couplet of Young's *Night Thoughts*—

> "At thirty, man suspects himself a fool;
> Knows it at forty, and reforms his plan"—

comes home with peculiar force, and in vain he may attempt to

> "Be wise with speed;
> A fool at forty is a fool indeed!"

And great must be the folly of those men who, intending to make teaching their profession, take service as assistant-masters in preparatory schools. Mr. Cotterill tries to show that things may be bettered in the future by a more frequent stepping of the assistant into the shoes of his chief, or, failing this, by a scheme of profit-sharing; but he does not appear sanguine of much relief in these directions, and the blot, as he rightly calls it, is only too likely to remain.

The Inevitable Comparison with Germany.—We have already said that the account given of the preparatory schools in this volume is decidedly an exhaustive one. We cannot, therefore, pretend to do more than to indicate the nature of it. The curious reader may obtain the Report for 2s. 3½d. at the Queen's printers. Our sketch will perforce conclude with an examination of Mr. Sadler's comparison with what obtains in similar schools in the Fatherland. This is done by taking the first three years of the German gymnasium, etc., as corresponding to the preparatory school course; for it is needless to say that our German cousins have no such anomalies in their midst. In the first place, the English boy is condemned to a boarding school; whilst the German, whose school is invariably a day school, has the advantage of home life: but as home is not always the best place for a boy to be, because parents are either too careless or too busy in the pursuit of business or pleasure to attend to him, and as, moreover, the training done by boys upon boys at a boarding school has much that is good in it, Mr. Sadler does not lay much stress upon the German gain in this connection. What he does say, and that with not too much emphasis, will appear from the quotation that follows, which, whilst exhausting our space, by no means exhausts the interest that we have in Mr. Sadler's sixth volume:—"However strongly we may feel the wisdom of the Frankfort plan, and however much we may desire to see the day when Latin will be postponed till about thirteen (and Greek two years later still), and the time so saved devoted to the study of French, and to careful training in English composition, English literature, the elements of natural science, history and geography, drawing and manual exercises, so adjusted in a well-balanced curriculum as to form a broad and stable basis for a liberal education, we must nevertheless regretfully admit that, so far as our most famous English schools are concerned, the day of that reform is still remotely distant. But even if we compare the English curriculum with the strictly classical curriculum of the Prussian gymnasium of the old type, or with the corresponding course of study in Britain, how specialised is the English course, and how meagre is its provision of teaching in some of those subjects which would be likely to have a liberalising effect upon the mind! The study of English, the reading of English literature, the writing of English composition, have shrunk to three quarters of an hour a week. For French there is only half an hour a day. For history and geography there is only half as much time allowed per week as the German curricula provide.

"Nature study and natural science are still a blank. Mathematics has mounted up to six hours a week; five hours a week is given to Greek—that is to say, a third foreign language (a second dead one) is set to the English boy at a time when even one hour a week cannot be spared for the study of his own mother tongue. Latin has risen to eleven hours a week, or nearly twice as much as any other subject."

LEAVING CERTIFICATE (SCOTLAND).

CIRCULAR 302, dated 20th December, notifies that the Leaving Certificate Examinations are to begin on Wednesday, 19th June, and that applications from State-aided schools must be made as soon as possible after 1st February, and not later than 1st April.

The circular, with the exception of an important new paragraph on Group Leaving Certificates, is similar to that issued last year. Group Leaving Certificates are to be issued to those candidates who have been receiving higher instruction for not less than four years in some recognised school, and who have obtained, during that period, certificates of the Higher Grade, or in Honours, in at least four subjects, of which one must be English, one an ancient or modern foreign language, and one mathematics, or, in the case of girls, higher arithmetic.

It is permitted to take a certificate in science instead of the higher in ancient or modern foreign languages; while in place of the fourth (optional) higher, two lowers may be taken. Where a candidate has three Leaving Certificates in languages, a pass in one of the additional mathematical subjects, or in book-keeping and commercial arithmetic, may replace one of the lowers.

Other options, duly noted, are allowed in the case of girls. The grade in which a candidate passes in each subject is to be recorded on the Group Certificates, applications for which must be made by the official correspondent of the school, on a special form, to be obtained from the Department.

DRAWING WITH CHALK ON THE BLACKBOARD

is the title of a series of articles now appearing in

THE PRACTICAL TEACHER'S ART MONTHLY.

Price Threepence.

OUR CLASS ROOM AIDS

BLACKBOARD DRAWING.

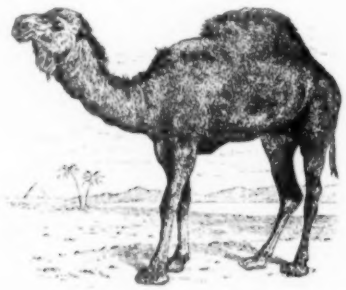
COPYING ILLUSTRATIONS.

BY EDITH E. BAMFORD, ART TEACHER, EDGE HILL TRAINING COLLEGE.

IX.

A FEW hints on copying animals from illustrations will now bring this series of articles to a close. The general rules for these sketches are the same as those given in the previous article on copying illustrations.

Instead of putting a block round the outline, as is often advocated, time is saved and skill gained by trying to obtain both the proportion and general shape by means of straight lines, where these are possible. In the first exercises the proportion will probably be inexact; but after some little practice it can be obtained fairly accurately, as a rule, by this direct method. In this first stage, it is *very* important that the joints be clearly indicated and emphasised.



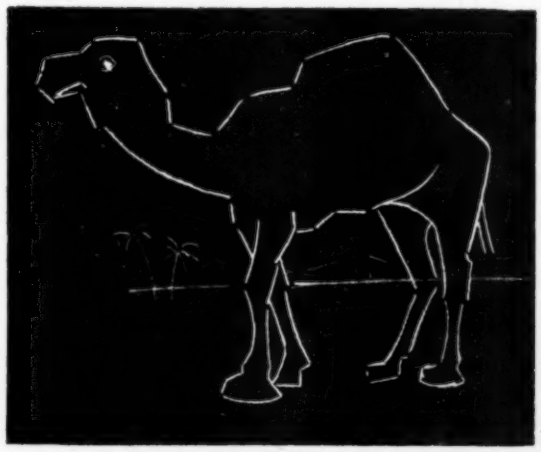
In the second stage, the blocking lines should be curved where necessary; but it is better to make the figure too angular rather than too round, or the sketch loses its character and vigour. For this reason the preliminary sketch is often stronger and more masterly than the completed drawing. If the delicate curves of the body of an animal be attempted, the drawing must be highly finished, and considerable time spent on it; for unless the curves are well reproduced, the sketch will look as though it had been made from a stuffed cloth model. A vigorous reproduction, however, which will be sufficiently suggestive of the form, can be readily made if the details are omitted and the essentialities only attempted.

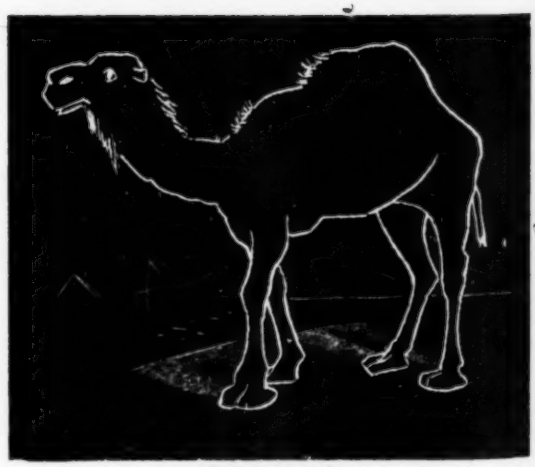
Special care should be bestowed upon the sketching of the head and feet. The joints in the feet should be closely reproduced; and here again the parts should be too angular rather than too round.

If the animal is standing on the ground, the latter should be indicated, or the animal will seem to be suspended in mid-air. A few horizontal lines for the shadow may be sufficient, or a few strokes to represent grass or foliage. The animal does not stand out clearly if much detail is added to the background, and not more than is absolutely necessary should be sketched.

Examples of such blackboard drawings are here reproduced, and, as in the previous article, photographic representations of the drawings, together with the illustrations from Nelson's reading books, are shown.

1. **The Dromedary.**—Two drawings are given. The first is the preliminary sketch, where the form and proportion are indicated by straight lines, which are drawn directly without the aid of any construction lines. Though the proportion is not exact, it is sufficiently so for the purpose. The second sketch is supposed to represent the first after it has been half cleaned out with the duster, and then lined in with a heavy chalk line, the angles being slightly rounded, and a little more detail added. These two sketches show





THE DROMEDARY.

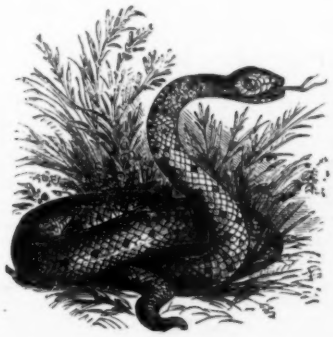
the general method of obtaining the outline of any animal from an illustration.

2. **The Snake.**—Here a little shading is introduced to give roundness to the form. The dark markings on the skin are represented by light markings, as this is the readiest way of showing them, and probably the difference does not signify.

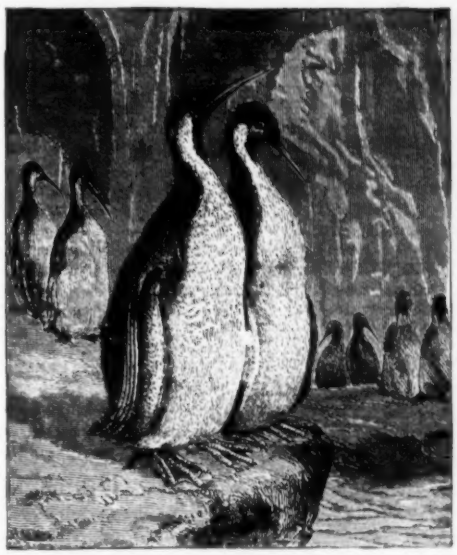
3. **The Penguins.**—This sketch is more heavily shaded, and has more detail in the background. A few strokes only should be used to indicate the birds in the distance; for if

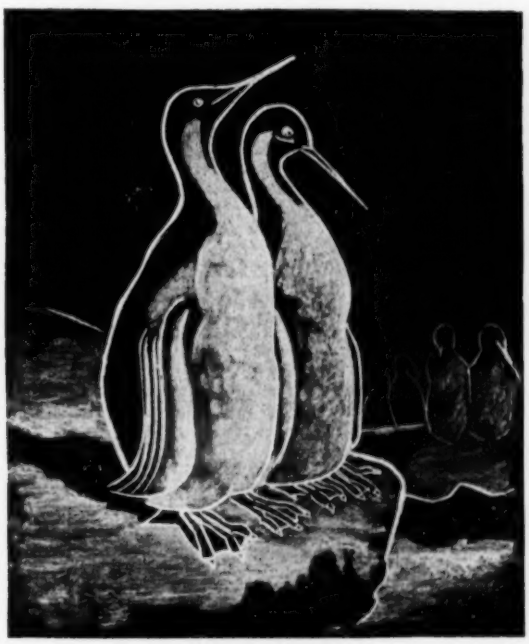
the working be elaborate, it will detract from the clearness of the principal part of the sketch.

If the course suggested in these articles be followed, the teacher will be able to sketch sufficiently well to illustrate his lessons effectively on the blackboard, and so make his teaching more thorough and interesting. The methods described are not always the best for training in drawing, but they are the readiest for turning the knowledge already possessed to the practical use of making illustrations for lessons. A skilled draughtsman might find that some of the mechanical methods advocated would hamper rather than help him; but it must be remembered that they are intended to assist those teachers who have had little training in drawing, in producing bold, clear, and fairly correct sketches with speed and dexterity.



THE SNAKE.





THE PENGUINS.

PRACTICAL ELEMENTARY SCIENCE.

AN EXPERIMENTAL COURSE COVERING THE REQUIREMENTS OF BOTH THE DAY AND EVENING SCHOOL CODES IN PHYSICS AND CHEMISTRY.*

BY THOMAS CARTWRIGHT, B.A., B.SC.,

Author of "Practical Chemistry," "'Section One' Physiography," etc.

Search for the Active Constituent of Air.—The fact that air consists of an active and of an inactive constituent having been experimentally established, we proceed to the next step, which consists in the isolation of these two gases, in order that they may be well examined, to the end that a thorough acquaintance with their properties may be acquired. At the outset, the difficulties of the problem may usefully be discussed, and, by way of preliminary, the student should be asked to state what was left behind when the candle or phosphorus went out, or when the iron was rusted. This should lead to the statement of the important truth that it is quite easy to obtain the inactive part of air, since its very inactivity causes it to remain in isolation when the active part enters into combination with the various substances submitted to it for that purpose. Contrariwise, it should be seen that it is much more difficult to isolate the active part of air, because, albeit that it readily separates from the inactive part by combining with iron, phosphorus, or the

* Books referred to in this series of articles are published by T. Nelson and Sons.

constituents of candle and other combustibles, it is exceedingly difficult to break up the new bodies formed by the union of the active part of air with the aforementioned bodies. To emphasise this fact, the teacher may place rust of iron in a test-tube and expose it to the heat of a bunsen flame. It will be evident that the iron is too firmly united to the active part of air for a separation to be effected, even by prolonged heating. The pupils may be told that iron is by no means peculiar in uniting so strongly with the active part of air as to make it practically impossible to get the active constituent of air by breaking up the compound. An attempt to break up the white compound of magnesium and the active part of air will prove equally abortive; and, indeed, all the bodies that we have hitherto formed in using up the active part of air exhibit the same provoking stability, so that it is hopeless to use them in our endeavours to isolate that fifth part of air to which its activity is due. Fortunately there are other bodies capable of fixing the active part of air which are more tractable in respect to decomposition than those we have just discussed, and with two of these—namely, **lead** and **mercury** (or quicksilver)—we now proceed to deal.

Lead and the Active Constituent of Air.—Take a crucible, and place therein some thin strips of lead. Place the crucible on a pipeclay triangle over a bunsen flame, and let the scholars observe what happens; then let them state what this teaches with respect to the peculiar properties of lead. When the lead has melted, the surface should be carefully examined, after which the molten mass should, from time to time, be well stirred with a long nail or a piece of stout iron wire. When a sufficient quantity of the yellow powder, that forms as a scum on the surface of the molten lead, has been produced, it should be scraped off, and should be placed in a second crucible, there to be subjected to a further heating, with the view to changing as much as possible of the yellow powder into the red powder that will presently be seen to form in the second crucible. As soon as the scholars see clearly that lead, when heated in air, is converted first of all into a yellow and then into a red substance, the teacher may stop the heating, and procure a sufficient supply of the red powder for his experiment from his stock of red lead, whereby much time may be saved.

Explanation of the Reaction.—What has been happening to the lead whilst it has been changing from metallic lead to a yellow and then to a red powder? It will not be difficult to get the children to see that the active part of our atmosphere has again been at work, and that the yellow body (which is the well-known **litharge** or **massicot**, so useful in the manufacture of glass) and the red body (equally well known as red lead) are simply the compounds of lead with the active part of air. Specimens of both litharge and red lead may usefully, at this juncture, be shown for examination by the pupils. As a proof of the fact that the lead has gained something from somewhere during the change that has been noted, the teacher may weigh the crucible containing the lead before and after the experiment, and it should not be difficult to get the pupils themselves to suggest that the gain has been at the expense of the active part of air. But the most convincing proof will be the recovery of some of the active air from the red lead, which should be our next step.

Recovery of the Active Part of Air from Red Lead.—In a rough and ready way this may be done by heating a portion of the red lead in a hard glass test-tube, the thumb being held over the mouth of the test-tube in order to prevent the escape of any of the gas into the air, a step rendered absolutely necessary by the fact that the amount of gas given off is very small, hence the need for ensuring that none escapes. The presence of the active part of air in the test-tube is to be proved in the usual way—namely, by the introduction of a smouldering splinter of wood into the gas, the reignition of which is a striking proof of the presence of a gas in the test-tube more active than air in the production of combustion. But there is so much risk in making the presence of the active part of air evident by heating the red lead in a test-tube, that we advise the teacher to follow the more tedious but surer method we are about to describe. Fit up a *hard glass* test-tube with a delivery-tube, the end of which passes under a beehive shelf under water in a basin, and having over the exit hole an inverted wide-mouthed bottle filled with water. Fix the test-tube to a retort-stand, and after having placed sufficient red lead in the test-tube to one quarter fill it, proceed to heat the test-tube with a bunsen burner. The first bubbles that come over are, of course, due to the expulsion of the air from the test-tube. The bottle should therefore be placed on one side to allow the air thus driven over to escape, after which the bottle should be replaced in its position over the exit hole of the beehive shelf, ready to catch the active part of air that is driven off when the temperature is sufficiently high for the purpose; and it will be good to draw particular attention to the fact that a high temperature *is* required. Having demonstrated that the red lead *does* give up some at least of the active part of the air by means of the smouldering splinter of wood, attention may now be given to the test-tube and its residual contents. Of what does the residuum consist? It is yellow in colour. Compare it with the litharge that resulted from the heating of the lead. It *is* litharge, and it will be futile to strive by further heating to drive off the remainder of the active air; a fact that again bears testimony to the strength of the union between the active constituent of air and the bodies with which it unites, such bodies, as a rule, being characterised by their extreme stability, so that bodies which, like red lead, give off the whole or a part of the active air with which they are in combination are quite the exception.

The Case of Quicksilver.—If the teacher wishes to combine quicksilver with the active part of air, he will have to heat the metal in contact with an enclosed volume of air for many hours, and even days, before he succeeds in accomplishing his purpose, for mercury combines with the active part of air with great difficulty. If possible, it will be very advisable to bring about this tardy combination, since the experiment is a classical one, being, in fact, the identical reaction by which Joseph Priestley in 1776 first did what we are now striving to do—namely, first separated the active part of air from the inactive part by first fixing it by means of mercury, and then recovered it by heating the mercury compound. The apparatus required is simply a retort containing mercury, the beak of which is well above the level of the water that encloses the air from which the mercury is to abstract the active part. (See Fig. 36, page 42, Cartwright's *Elementary Practical Chemistry*.) Whether the experiment in question is worked for the instruction of the class or not, the setting free of the active part of air from the mercury compound known as red precipitate *must* be performed by every pupil.

Recovery of the Active Part of Air after its Fixation by Mercury.—In a hard glass test-tube place as much red precipitate as would cover a sixpence. Heat the test-tube in a bunsen burner, and carefully note all that takes place when the red powder is heated. Take a smouldering splinter and insert it in the mouth of the test-tube, and note what takes place. How can you explain this? Observe the sides of the test-tube. With a lead pencil or a glass rod rub off the substance deposited on the sides of the tube, and again record what you witness. Bearing in mind the fact that red precipitate can be formed in exactly the same way as red lead was made, and that we get quicksilver and the active part of air from it when we heat it, show that we have succeeded in setting free the active part of air, and in separating it from the inactive part. The active gas which we have thus succeeded in isolating was called **oxygen** by the great French chemist **Lavoisier**, who repeated and perfected the Priestley experiment. Oxygen is now manufactured on a large scale by an improved mode of fixing it by barium peroxide, and then setting it free from this compound; but we shall prepare it by decomposing a body that is very rich in it, and not by separating it from air, which, as we have shown, is a lengthy process yielding the gas only in small quantities.

Preparation of Oxygen.—Powder some chlorate of potash, and mix it with a quantity of manganese dioxide until the colour of the mixture is greyish. Place the mixture in either a hard glass test-tube, a retort, or a flask provided with a delivery-tube passing under a bee-

hive shelf resting under water in a basin, and over the hole of the shelf place a wide-necked bottle, or a gas jar, filled with water. Heat the mixture carefully, and be prepared to collect six bottles of the gas by displacement of water. Care should be taken to remove the light as soon as the gas begins to come off, as the action tends to become very rapid when once it has commenced, and much of the gas will be lost if this rush is not prevented by removing the light as soon as the action commences, and by very careful heating after this stage has been reached. When the water begins to ascend the delivery-tube, heat should at once be applied, or the water will rush up and break the retort, as is most frequently the case with beginners. It will be very instructive to get the children to explain the why and the wherefore of these precautions. In order to preserve the gas, the mouths of the bottles should be closed by glass plates, which should be greased to make the joint air-tight.

Experiments with Oxygen.—We have oxygen ever present in the air, mixed, it is true, with four-fifths its bulk of another gas, and we know that air is invisible and inodorous; hence we may assume the same to be true of oxygen. Moreover, we know that the waters of the ocean do not dissolve the atmosphere that is ever in contact with them; hence also we may assume that oxygen is not very soluble in water, a fact that we must congratulate ourselves upon, as it would be disastrous if the waters of the ocean were constantly making large inroads upon the stock of precious oxygen. These experiments we shall not repeat, but we shall content ourselves with examining the burning of metals and non-metals in oxygen as compared with their combustion in air, and we shall specially have an attentive eye to the products of these various experiments in burning. We shall require pieces of phosphorus, sulphur, and sodium about the size of a pea, some fine iron wire, magnesium ribbon, and powdered charcoal, and a deflagrating spoon in which to hold them whilst they are burning. These latter may be extemporised from lengths of copper wire by twisting the wire round and round at one end to make a small cup-like receptacle. A piece of cardboard sufficiently large to cover the top of the bottle, and having a perforation in the middle just wide enough to allow the wire to pass with difficulty, will also be required, the cup being just far enough through to escape touching the bottom of the bottle. The sulphur should be just set burning, and the kind of flame thus produced should be noted before placing the deflagrating spoon in the bottle. After the action has ceased, some water is to be shaken up in the bottle, the hand being kept tightly over the mouth, in order to see if there is any sucking down, which should be seen to betoken solution of the substance. The like should be done after each of the substances has been burnt. It will be found necessary to melt the sodium, and to place it smartly in the bottle as soon as it begins to burn. The iron will also require care. It should be twisted up loosely in a ball, and a small quantity of sulphur should be placed in the spoon with it in order to start the action. It will be very easy to distinguish the burning of the iron from that of the sulphur that precedes it. After the jars have all been used, and water has been added, the first question is, has there been any solution? which, in other words, means, has the hand been sucked down? Then, after allowing time for complete solution, the water in each jar or bottle should be divided into two portions, to one of which a solution of red, to the other a solution of blue litmus is to be added, and a very careful observation must in each case be made of any colour changes that have resulted. The bodies thus made are **oxides** of metals and of non-metals respectively, and no part of the work is more important than this examination of the effect of water and of litmus upon oxides. The solid oxide of magnesium should be taken from the spoon, and should be placed upon a piece of moistened red litmus-paper. Careful questioning as to what is evident should be resorted to whilst yet the results obtained are before the eyes of the class, and, if necessary, the experiments should be repeated until decisive results are obtained, the points to be made clear being as follows:—(1) Oxygen is an exceedingly active gas, because many bodies burn in it that do not burn in air (for example, iron), and those that burn in air burn much more brilliantly in oxygen; (2) the non-metallic oxides are more often soluble in water than are metallic oxides; and (3) the non-metallic oxides turn blue litmus red, whereas metallic oxides (when soluble) turn red litmus blue. This opposition in properties between metallic and non-metallic oxides must be insisted upon as of first-rate importance. (For further particulars under this head see chap. vii., page 41, of Cartwright's *Elementary Practical Chemistry*.)

OUR ILLUSTRATED GEOGRAPHICAL NOTEBOOK.

ASHANTI.

OUR possessions in Western Africa are to the average Briton but the very byways of empire, and, in any enumeration of our world-wide interests, might be almost, if not entirely, overlooked.

Gold Coast Colony has a sea frontage of about 350 miles, and though the interior boundaries may not be very strictly defined, the colony embraces at least 15,000 square miles, with a population of about two millions.

ASHANTI.

Ashanti, a native state lying inland at the back of the central portion of Gold Coast Colony, with an area of quite 30,000 square miles, and a population variously estimated from one to three millions, now forms a definite part of the British Empire.

History.—The Ashantis, supposed to consist of various native tribes driven south by various northern Moslem tribes, speedily asserted their superiority over the weaker Fantis, who occupied the coast regions. It was in the early years of the last century that the British first came in contact with the Ashantis. About 1807 two chiefs of the Assins, who had been defeated by their warlike neighbours, took refuge with the Fantis. The Ashantis invaded the Fanti country, and eventually reached Annamaboe. The town was destroyed, and a large number of the inhabitants perished. The garrison of a small British fort, however, defied all efforts of the natives, until a treaty was concluded, by which the Fanti territory, including Cape Coast Castle, was ceded to the King of Ashanti.

In 1823 and 1863 punitive expeditions were necessary to keep the Ashantis within their own borders.

In 1873 it became absolutely necessary for the British to take stern measures against the Ashantis, and Sir Garnet Wolseley reached the coast in December with a force of about 2,500 men. The aggressive warriors were driven within their own borders, and at Amoaful a splendid victory was gained by the British at a cost of only seven men killed. Several days later, Kumasi, the capital, was entered, and on February 6 it was committed to the flames. King Koffee undertook to pay an indemnity of 50,000 ounces of gold, to renounce his claims over certain native tribes, to grant free trade, together with open communication with the coast, and to abandon the hideous practice of wholesale human sacrifices.

The conditions of the treaty were by no means faithfully carried out, and the reign of King Prempeh was marked by perhaps even worse excesses than obtained during the reign of his predecessor. In 1895 a British force again traversed the country; Kumasi was entered, and the king taken prisoner, without a battle being fought. Prempeh was exiled to Sierra Leone, where he still remains. In this expedition, Prince Henry of Battenberg, a son-in-law of Queen Victoria, fell a victim to malarial fever.

In 1900 the Ashantis again made an attempt to throw off the British yoke. Doubtless the natives do not take kindly to restraint; they do not care about forced labour on public works; and they object to pressure to act as government carriers. These grievances were perhaps brought to a head by the Governor, Sir Frederick Hodgson, demanding the golden stool, the symbol of monarchy with the Ashantis. Taking advantage of the wet season, the natives revolted, and for long weeks the British garrison in Kumasi was besieged by hordes of desperate warriors. British pluck

and strategy outwitted them until help arrived, after which the suppression of the revolt speedily followed.

People.—The Ashantis compare very favourably with many other tribes of Western Africa. The men are taller and better-proportioned than the average negro, and the women are by no means ill-favoured. They show various traces of Moorish civilisation, which bears out the idea of their northern origin; and they are quite expert in the manufacture of cotton cloth, leather, and sword-blades.

The distinguishing feature of the people, however, is a passion for the shedding of human blood. They display an indifference to human life and suffering that is appalling; and when the war drums—strange cylindrical instruments varnished with human blood and decked with human bones—have sounded the dance of death, neither age nor sex is spared. Even in times of peace they used to satisfy their ferocious desire for blood in various festivals at frequent intervals. The death of a king was always marked by a wholesale butchery of victims. The system of human sacrifice rested mainly on the native idea of veneration for their parents and relatives. It was imagined that a chief's rank in the invisible world depended upon the number of followers he could claim, hence the desire to dispatch as many as possible to him after death.

"Before their power was broken by the English, the Ashantis had established an absolute government based on

an organised system of terror.....The king ruled over a nation of grovellings, awed or terror-stricken at his every word or gesture.....One of the chief functionaries of the royal household was the head executioner, who wore, as an emblem of his office, a gold axe in a loop of his dress. The pages were armed with fetish weapons, enabling them to plunder indiscriminately and with impunity. The sovereign was, moreover, the legal heir of all the gold, gems, and precious objects belonging to his subjects, and on grand occasions he decreed a general confiscation of property on behalf of the treasury.

"To break an egg or spill any palm-oil in the streets of Kumasi were capital offences. The arms of murderers were struck off before being killed, and the bleeding wretches had then to perform a funeral dance in the king's presence, lighted torches being applied to their wounds to stimulate them in the execution of the prescribed gambols.....One of the streets of Kumasi was called 'Never dry of blood,' and, according to a Fanti play of words, the very name of the city meant 'Kill them all.'"—(*Reclus.*)

Productions.—The country is covered with dense forests, which abound in elephants, gazelles, wild boars, and other smaller animals. The chief trees are the bamboo, oil-palm, plantain, and rubber tree. Yams form the staple vegetable food of the natives, and rice, corn, and sugar-cane are grown. The country is rich in metals, and gold is very abundant.

The *oil-palm* yields nuts from which an orange-coloured grease is procured. It is obtained by crushing the nuts and soaking them in water. The oil is largely used in the manufacture of candles, and also as a lubricant for machinery.

The *plantain* is a tree that averages from 20 to 30 feet in height, and is, in almost every respect, similar to the banana. The leaves, about 6 feet long and 2 feet wide, grow in a cluster at the top; and the fruit, though less agreeable in flavour than the banana, is a valuable native food.

The *yam* is a climbing plant common in the forest regions. The large tuberous roots form an important bread-stuff.

Future Prospects.—It is a matter of difficulty to estimate the prospects of the country in the near future. The climate is unhealthy for Europeans, of whom there are only a few hundreds in the Gold Coast territory. That the trade has been trebled within the last ten years is a matter for congratulation: exports, £706,000; imports, £690,000.

A railway is now in course of construction from *Secondi* to *Tarkwa*, from whence it will be taken to Kumasi. In this part of the world railway construction is beset with innumerable difficulties. Dense forests, an unhealthy climate, remarkably wet seasons, poor communications between the coast and the interior, and scarcity of labour are but a few of the hindrances which the engineer has to overcome. In November last a survey party of twenty-seven set out on their work, and to carry their apparatus, food, etc., required the services of no less than 1,700 native carriers. Clearing the forests presents great obstacles to progress, and embankments, wherever necessary, are thrown up by means of hand-carried baskets, instead of tip-wagons, as in our own country.

When the railway is completed, the colonisation of the whole territory will make rapid strides. The clearing of the forests, and the success of medical investigation into the causes of malarial fever, will do much to render this portion of the African continent more habitable for white men. The gold-mining industry will perhaps be the first to benefit from the railway, but it is probably as a field for rubber cultivation that Ashanti will find no inconsiderable opening for development.

The recent rising will result in the more efficient policing of the country, so that a recurrence of the trouble may not be looked for again. This duty will be undertaken chiefly by the West African Frontier Force, the rank and file of which consist chiefly of recruits from the Hausa and Yoruba tribes. These men are of splendid physique, and possess unrivalled ability for fatigue duty of all kinds. The recent expedition was formed almost entirely of these men, under Colonel Willcocks, whose brilliant services were a great factor in the suppression of the revolt. When the time is ripe for the writing of the story of the rise and progress of the Gold Coast Colony, we shall find the West African Frontier Force will have played a conspicuous part in developing and humanising one of the dark spots of the earth.

ELEMENTARY LESSONS IN THE PRINCIPLES OF GRAMMAR.

A Course of Forty Oral Lessons for the First Year (New Code, Standard IV.).

BY JOHN R. TIMSON, B.A.

LESSON XXXVI.

PARTICIPLES.

NEARLY all verbs have a form ending in "ing"—for example, being, having, writing. This form is called the Present Participle. It is used with the verb "to be" to form the imperfect tenses; for example,—

Present imperfect.....I am writing.
Past imperfect.....I was writing.
Future imperfect.....I shall be writing.

The present participle "being" is often used after a noun or pronoun in order to introduce another noun, an adjective, an adverb, or a prepositional phrase:—

Tom, *being a scholar*, can answer us.
John, *being good*, shall have a penny.
The man, *being here*, can help us.
The pudding, *being in the saucepan*, will soon be done.

In all these cases "being" is attached to a noun or pronoun, and is therefore an adjective.

The participle sometimes shares or takes part in the office of a verb, sometimes in the office of an adjective. The Latin word *participio* means "I take part."

The word "being" may also be used to *name* a state or condition; for example,—

Being a scholar is by itself of little use.
Being good brings happiness.
Being here is better than being there.
Being in the pan is almost as hot as being in the fire.

In all these cases the phrase names the subject. "Being" is parsed as a noun.

It may also name the object,—He likes *being wet*.

The form of the verb in "ing," when used as a noun, is called the Gerund.

This form may be used in three ways:—

1. As an adjective,— A *singing* bird.
2. As part of a verb,—The bird *is singing*.
3. As a noun,—*Singing* is enjoyable.

A participle is not a new part of speech. We must name it by the office it performs.

He, *having* many friends, fears no one.
Having.....Present participle, used as an adjective, qualifying "he."
Friends.....Objective case, governed by "having."
Having money is not equal to *having* sense.
Having.....Gerund, nominative case to "is."
Having.....Gerund, objective case, governed by "to."
The birds, singing gaily, came at my call.
Singing.....Present participle, qualifying "birds."
Throwing stones is dangerous.
Throwing...Gerund, nominative case to "is."

The participle in "ing" is called the present participle, to distinguish it from the past participle, which ends in "ed" or "en"; for example, "walked," "spoken."

The past participle is used with the verb "to have," to form the perfect tenses; for example,—

Present perfect.....I have written.
Past perfect.....I had written.
Future perfect.....I shall have written.

The past participle is often an adjective—for example, a *loaded* gun, a *broken* stick.

A book *written* in haste seldom rewards the author.
Written.....Adjective, qualifying "book."

The auxiliary verb "to have" indicates perfect tense, and the participle "having" is used to mark completeness of the action indicated by other participles; as,—

Having written his letter, he went out.
Having written..... Perfect participle, used as an adjective, qualifying "he."

The verb "to be" indicates imperfect tense, and the participle "being" is used to mark continuance of action.

Being worked by steam, the wheel revolves rapidly.
Being worked.....Imperfect participle, qualifying "wheel."

"Having been" denotes perfect progressive action—that is, action going on and then completed.

The boy, *having been writing*, can now play.
Having been writing.....Perfect progressive participle, qualifying "boy."

Present participle	Writing.
Past participle	Written.
Perfect participles	Having written. / Having been written.
Imperfect participle	Being written.
Perfect progressive participle	Having been writing.

MEMORY NOTES.

A participle is that form of a verb which is used not only as part of the verb, but also as an adjective.

The *playing* boy.....Adjective.
The boy *is playing*.....Verb.

A participle of itself is never a verb, but requires an auxiliary verb to form an assertion.

The present participle ends in "ing," and with the verb "to be" forms imperfect tenses,—I am writing.

The past participle ends in "ed" or "en," and with the verb "to have" forms perfect tenses,—I have written.

The perfect participle is formed with "having,"—having written.

The imperfect participle is formed with "being,"—being written.

The perfect progressive participle is formed with "having been,"—having been writing.

LESSON XXXVII.

THE PASSIVE VOICE.

Two kinds of action give rise to two classes of verbs:—

1. Action beginning and ending with the doer,—The boy *swims*.
2. Action beginning with a doer and ending with a receiver,—The boy *throws* a stone.

Verbs which indicate actions that do not pass to an object are called intransitive.

Verbs which indicate action passing from a doer to a receiver are called transitive.

The man beats the boy.

The man *does* the beating, the boy *receives* the beating. The man is *beating*, the boy is *beaten*. The verb "is beating" is said to be active—that is, doing; the verb "is beaten" is said to be passive—that is, enduring or receiving.

We may speak of a *beating* man or a *beaten* boy. The present participle is active, and the past participle is passive. With a noun or a pronoun they are adjectives.

Everything may be considered as either active or passive. Things which live, move, and do things, are active. Things which are still, dead, and are acted upon, are passive. The walking man is active, the ground is passive. In kneading the dough, the woman is active, the dough is passive. If the voice of the speaker asserts of the woman as subject, "The woman kneads the dough," the verb "kneads" is in the active voice. If the voice of the speaker asserts of the dough as subject, "The dough is kneaded by the woman," then the verb "is kneaded" is in the passive voice.

When an assertion is made concerning the doer, the verb is in the active voice.

When an assertion is made concerning the receiver, the verb is in the passive voice.

Whether the verb is in the active or passive voice depends on the assertion of the speaker being made of the doer or of the receiver of the action. This distinction is rightly called "voice," for the verb is the only word indicating the voice of the speaker. All other words are marks to indicate things, qualities, actions, or their connections; but we look through the verb to the speaker himself, and our acceptance of his assertion depends upon whether we can take his word or not.

A speaker, then, may take either the doer or the receiver of an action to be the subject of his assertion.

The boy *is eating* the fish.
Is eating....Active voice, because the subject "boy" is the doer.
The fish *is eaten* by the boy.
Is eaten.....Passive voice, because the subject "fish" is the receiver of the action.

Voice, then, is the distinction made by the speaker in choosing the doer or the receiver to be the subject of his assertion.

The *eating* boy is the doer of the action, and the *eaten* fish is the passive receiver of the action. "Eating" and "eaten" are adjectives qualifying "boy" and "fish" respectively. With the verb "to be" they are verbs,—"is eating," "is eaten."

The words "eating" and "eaten" are called participles, because they participate in the nature of both verbs and adjectives—sometimes being asserted of a subject, and sometimes qualifying nouns or pronouns.

Participles are partly adjectives, partly verbs. They may, perhaps, be more properly likened to the chameleon, a small lizard famous for changing its colour.

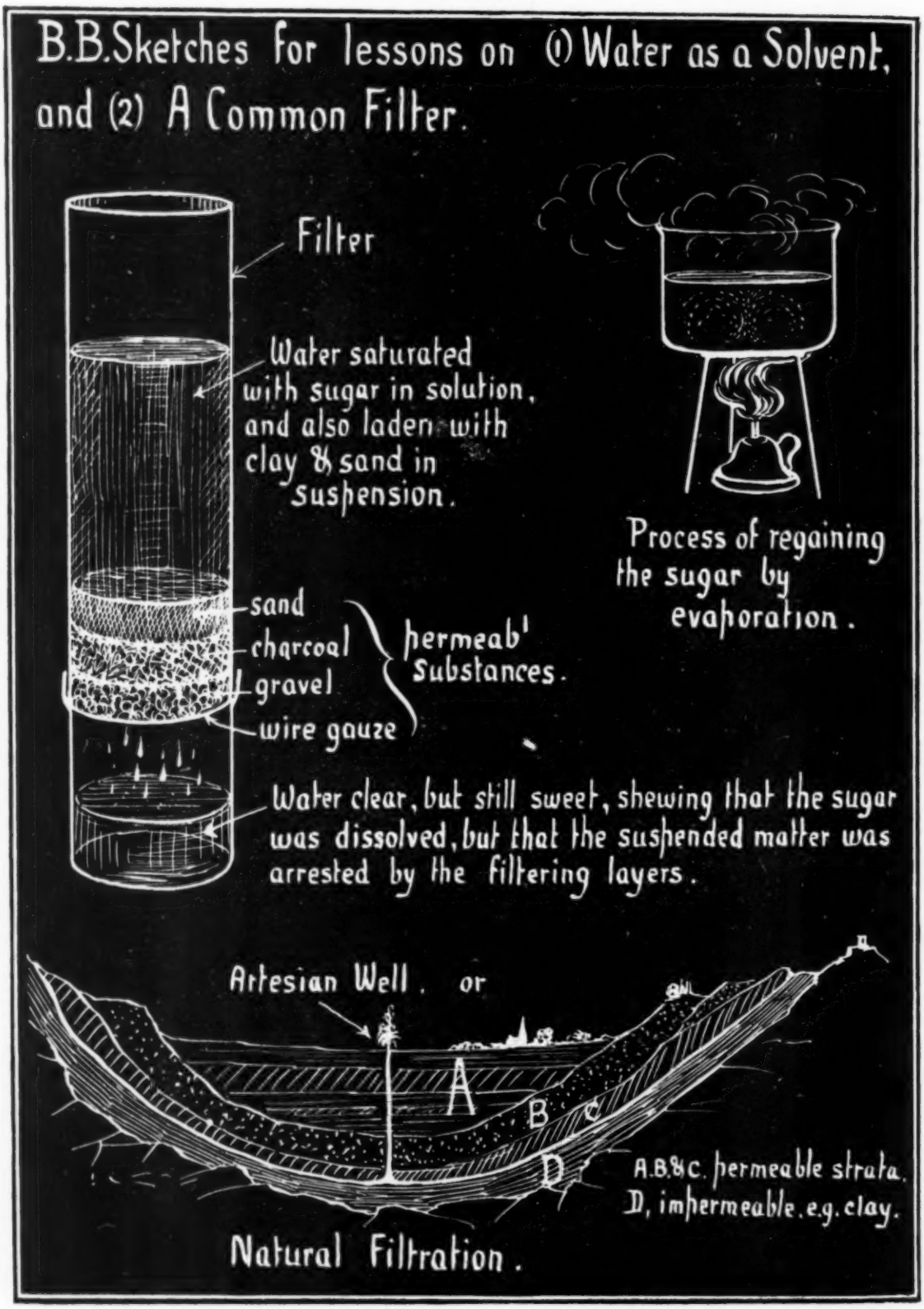
We must remember that only transitive verbs have the distinction of voice.

The passive voice of transitive verbs is formed by the verb "to be" and the past participle. "To beat" is active, "to be beaten" is passive. The verb "to be" is thus the auxiliary verb of the passive voice. We can now conjugate or arrange in order the tenses of the passive voice.

Present tense	I am beaten.
Past tense	I was beaten.
Future tense	I shall be beaten.
Present perfect tense	I have been beaten.
Past perfect tense	I had been beaten.
Future perfect tense	I shall have been beaten.
Present imperfect tense	I am being beaten.
Past imperfect tense	I was being beaten.
Future imperfect tense	I shall be being beaten.

BLACKBOARD ILLUSTRATION.

BY C. ARMSTRONG


B.B. Sketches for lessons on (1) Water as a Solvent, and (2) A Common Filter.
Filter
Water saturated with sugar in solution, and also laden with clay & sand in suspension.
Process of regaining the sugar by evaporation.
sand
charcoal
gravel
wire gauze
permeab' Substances.
Water clear, but still sweet, shewing that the sugar was dissolved, but that the suspended matter was arrested by the filtering layers.
Artesian Well, or
A
B
C
D
A.B.&C. permeable strata.
D, impermeable, e.g. clay.
Natural Filtration.

The participles of the active voice are:—
1. Present .....Beating.
2. Perfect.....Having beaten.
3. Perfect progressive...Having been beating.

The participles of the passive voice are:—
1. Past .....Beaten.
2. Imperfect .....Being beaten.
3. Perfect .....Having been beaten.

"Having beaten" is perfect, active voice.
"Having been beaten" is perfect, passive voice.

MEMORY NOTES.

Transitive verbs have two voices, the active and the passive.

When the doer of the action is denoted by the subject, the verb is in the passive voice; for example, I praise.

When the receiver of the action is denoted by the subject, the verb is in the active voice; for example, I am praised.

The passive voice is formed by the verb "to be" and the past participle, which generally ends in "en" or "ed"; for example,—

I am beaten.
I am touched.

A COURSE OF OBJECT LESSONS FOR GIRLS' SCHOOLS.

BY WILLIAM DONE, B.A.,

Head-Master of Brighton Pupil Teachers' School.

THIS course of lessons, which, it is hoped, will run through the numbers of THE PRACTICAL TEACHER for the current year, is specially designed as illustrating the elementary principles of domestic science. The lessons will be based upon the recommendations of Circular 369: "Any of the objects may be dealt with at the discretion of the teacher in more than one lesson, and it is not intended to prescribe any specified number of them for a yearly course. With different treatment, the same object may be adapted to more than one standard." It is to be hoped that the lessons will stimulate a spirit of inquiry amongst those who one day will be housewives, to reason the how and wherefore of simple domestic operations.

As far as possible, the facts will be demonstrated by experiment and observation; for, as knowledge enters by many doors, that which comes in a practical manner, by means of hand and eye, is most interesting and permanent to the young.

The apparatus needed by the teacher will be confined to such things as are at hand in any school or home, either in the town or the country.

The fitting up of these articles of illustration will furthermore be shown in such a manner that the teacher will be at no unnecessary trouble.

I. WATER AS A SOLVENT.

Articles of Illustration.—A spirit-lamp, some glasses to hold water, a flask or small kettle, pieces of lump sugar, soda, some salt, a patty-pan, some saucers.

EXPERIMENT OR ILLUSTRATION.	INFERENCE.
Take a glass of cold water and stir two or three lumps of sugar in it. There is no difference in the appearance of the water, though there is a difference in taste.	The sugar has thoroughly mixed with the water in such a manner that we say it has dissolved.
Take other glasses and dissolve salt and soda. In a fourth glass stir some sand. Pour some of the water with the salt dissolved in it into a patty-pan, and set it over the spirit-lamp.	Water dissolves some things, but not everything.
Take a glass of cold water and a glass of hot water. Suspend in each a piece of lump sugar by means of a cotton thread. Note the result.	Hot water dissolves the sugar more quickly than cold water.
Take four dirty saucers, two of which are greasy. Let a couple of girls wash these, one using cold water and one using hot water—each girl having one of the greasy saucers.	Hot water dissolves dirt quicker than cold water, but neither hot nor cold water will dissolve grease.
Take the patty-pan, from which the water by this time has all evaporated, and show the residue. Let some of the girls taste it.	The dissolved material has been recovered again by evaporating the water.

II. A COMMON FILTER.

Articles of Illustration.—Some tumblers of water, some powdered chalk, some salt, circular pieces of blotting-paper, glass funnel, a flower-pot into the hole of which a small glass tube has been fitted by means of a cork, a piece of sponge, some small gravel, wood charcoal, fine sand, a blue-bag.

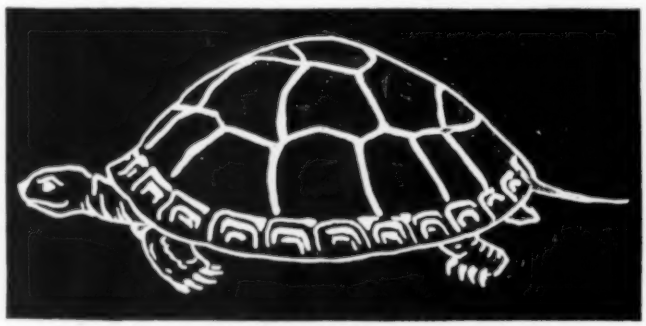
EXPERIMENT OR ILLUSTRATION.	INFERENCE.
Take three tumblers of water. Squeeze the blue-bag into one, stir some powdered chalk into the second, and some fine sand into the third. Observe the results.	The blue dissolves in the water, and thus we get a solution. The chalk and the sand remain undissolved, their particles sink to the bottom, though the chalk particles remain floating about in the body of the liquid, or suspended, longer than those of the sand.
When the sand particles have reached the bottom, carefully pour off the clear water. Give the term *decantation*.	Substances in suspension which sink quickly to the bottom can be recovered by decantation.
Take a circular piece of blotting-paper, double it, double it again to form a quadrant; carefully fit it into the glass funnel, taking three thicknesses on one side and one on the other. Moisten the paper so that it adheres to the funnel.	The blotting-paper is an unglazed paper, and it lines the funnel completely, so that anything poured through the funnel must first pass through the blotting-paper.
Stir up the chalk in the water and then pour very gently into the filter, being careful not to break the paper. Catch the filtrate in a clean glass.	Only the water can pass through the pores of the filter-paper; the suspended chalk particles remain on the paper.
Compare the two processes of decantation and filtration.	Filtration is a more complete method of removing suspended matter than decantation. Matters in solution cannot be removed by means of filtration.
Take a clean filter-paper and proceed in the same way with the blue solution. The filtrate is still blue.	Matters in solution can be recovered by evaporation.
Refer to the previous lesson, and ask how we got the salt back again from the salt solution.	
Construct a common filter. Take the flower-pot, into the hole of which a small piece of glass tubing has been fitted by means of a cork. Over this place a small piece of sponge or wire gauze, to prevent the materials above choking up the pipe. Next put in a layer of fine gravel, then a similar layer of small pieces of charcoal, followed by sand on the top.	This contrivance acts in the same way as the blotting-paper did—it removes matters in suspension from the water in which they are held. A filter similar to this might be made on a large scale. [The teacher might lead the inference further, so as to include the filter-beds for the water of the towns.]
Pour into the filter some water with matters in suspension. A glass of muddy water is best.	

NATURE LESSONS FOR INFANTS.

HOW ANIMALS AND PLANTS PROTECT THEMSELVES.

III.—SPECIAL WEAPONS WHICH ANIMALS POSSESS.

Preparation.—If possible, get a tortoise, a snail, a hedgehog, and a cat for these lessons. Both a tortoise and a hedgehog are quite easy to keep as pets, and their habits and appearance can

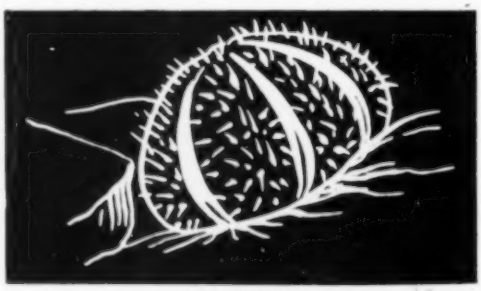


THE TORTOISE.

then be watched by the children themselves. Pictures should be provided of such animals mentioned as are not really well known to little children, and which could not be drawn on the blackboard sufficiently quickly. A child's horn trumpet and the antlers of a stag will be found useful.

Introduction.—We have seen that animals protect themselves from their many enemies by being coloured in such a way that they cannot easily be seen, and by making hiding-places in which they can safely rest.

In spite of all care, however, animals are often seen by their enemies, and then their only chance is to take to flight or to fight in order to defend themselves. Nature has provided them with many varying kinds of weapons for this purpose. Let the class



SEA-URCHIN.

name some of the weapons used by men for fighting, so that they may clearly understand what a weapon is.

There is hardly an animal to be found that has not its own

STING OF A SEA-ANEMONE.

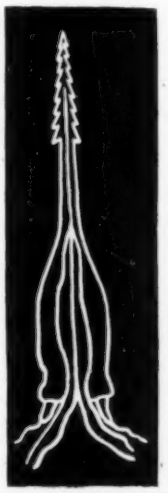
special weapon or weapons, so that we cannot possibly talk of all, but can only choose a few of the most interesting.

Teeth.—*Lions, tigers,* and most animals of their kind, use their weapons rather for attack than for protection, and their terrible claws and teeth are indeed justly feared.

Draw from the class the likeness of the cat to these animals. Show a cat, and let the children examine the teeth, and the claws drawn back under the soft pads.

The *tusks* of the *elephant* and *wild boar*, which can do so much damage, are nothing but specially-developed teeth.

A great many animals, such as the *wolf*, the *bear*, the *weasel*, and the *seal*, use their teeth as their most formidable weapon; while the teeth of the *shark* remind us that many *fish* have weapons not to be despised.



STING OF A BEE WITHOUT ITS SHEATH.

Horns and Antlers.—Ask the children what are the weapons of the *bull*, the *goat*, and the *stag*. Show a horn and a stag's antler to the children. Let them feel them, and so see what dangerous wounds could be made with them.

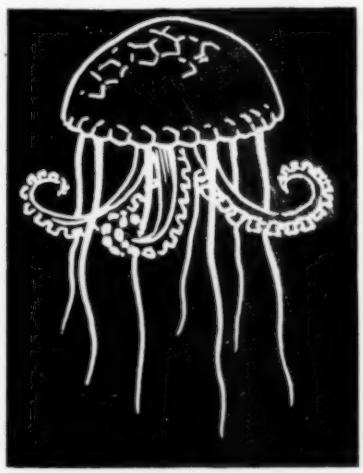
Spines.—Show a live or stuffed hedgehog, and the picture of a porcupine, and let the children find their weapons of defence. Picture a dog or a fox trying to get hold of a hedgehog with his feet or teeth, and let the class tell the result. Draw from the children the names of other animals that are protected by spines, and tell them about the sea-urchins with spines all over, and the fish which, like the perch and the stickleback, have spines only on the top of their backs.

Beaks and Talons.—Ask what are the eagle's weapons, and tell how he uses them. Lead children to see how it is that birds have so few powerful weapons of defence, because they can generally fly so easily from danger.

Weapons for Poisoning.—A great number of animals of very different kinds possess the power of poisoning their enemies, from the huge cobra to the tiny gnat. Let the children suggest some.

Some snakes have large poison bags in their mouths, and little sharp fangs. When they wish to attack any animal, they pierce its skin with these fangs, and then squeeze poison into the prick, which soon does its work.

The fangs of the spider act in much the same way; but when



THE JELLY-FISH.

they are not in use, they are shut back into cases just like a clasp-knife.

Ask the children if they have ever been stung by a bee or a wasp. Tell them that those stings are really the result of

poison being squeezed into the little wounds made by a tiny sort of dagger which bees and wasps have at the end of their bodies. Draw sting.

Sometimes, when bathing in the sea, people have been badly stung, and it has been found out that the sting was caused by a number of little poison pricks made by a jelly-fish. Draw a jelly-fish, with a sting enlarged.

Amongst many other creatures with stings is the beautiful little sea-anemone, of which we have spoken before; and though its sting is too tiny to hurt men and women, it is quite enough to be most unpleasant to a fish, if he wishes to make a meal of an anemone.

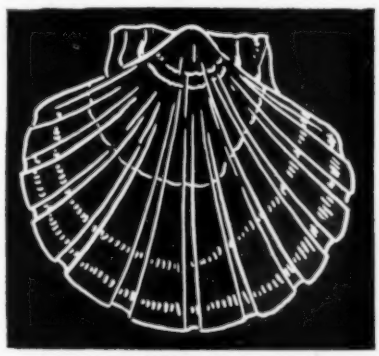
Armour.—Besides possessing weapons, many creatures are provided with armour. Sometimes they only have shields, but often they are completely encased in strong armour.

Remind children of the uses of armour, and the reason why none is worn by our soldiers now. Ask what kind of animals will most need armour. Show a snail, and let children notice its soft body, and what a complete protection its shell makes.

SHELL-FISH.

The numerous shells we find on the seashore, at one time protected the soft-bodied creatures which formed them. Let children name some shell-fish, and draw a few shells on the blackboard.

Crabs and lobsters and shrimps are covered with jointed



SHELL-FISH.

armour, so that they can move about more freely than shell-fish, and yet are protected.

It is not only creatures which live in the sea that possess armour, but some land ones are similarly protected. The tortoise can draw himself quite inside his bony covering, and so take care of himself; while the whole family of snakes are covered with armour made of small horny scales.

Tell the children to try to find out the special ways in which each animal that they see is able to protect itself—whether it is by its colour, by its strong weapons or armour, by its safe hiding-place, or by all these means at once.

THE ART OF STUDY.*

A BOOK has come into our hands for review which is so scholarly conceived, so sympathetic in tone, and so universally useful to the student and teacher alike, that we feel we cannot pass it by with simply a few remarks. It is the work of an American teacher, an enthusiast in pedagogy, compiled after mature experience, reading, and thought as regards the important questions involved in the acquisition of knowledge by pupils in schools. Dr. Hinsdale, the author, is the professor of the science and art of teaching in the University of Michigan, one of the oldest pedagogical chairs in the United States of America, and as such is a writer to whom a student and teacher should pay some attention. The book has been reviewed in America, and described as "one of the most important contributions to pedagogical literature in recent years." This is, no doubt, perfectly true as regards America, and we shall not be very far from the mark if we repeat the decision as far as the same kind of writings in England are concerned. It is certainly a most excellent book, and one that will well repay a diligent and careful study of it. It is psychology and school management all in one. The teacher is brought to see that his function is not to teach his pupil so many facts, and to fill him, so to speak, with so much knowledge, but to know his pupil, and to assist him in *acquiring* knowledge. The teacher is to become a child-student and a child-guide. He is to study the child as he did a book, the child now taking the place of the book. The child forms his habits of study while preparing his lessons; he acquires his art of study while actually studying; and it is the duty of the teacher to assist him to gain facility in the practice of this art. This facility must be based on sound pedagogical principles. Not a child in a hundred is used by a teacher in this way. We are speaking of our own country. Our classes at present are too large to permit even the most enthusiastic teacher to study a child as he would a book, to know him as he would the conjugation of a Latin verb. In America things may be altogether different. The idea, however, is a splendid one, and if it can be done only in part, so much the better for the teacher, so much the better for the child. The art of study is sadly neglected and very much misunderstood. There are failings of comprehension and weakness of appreciation among our pupils, which might be turned to strength did we know the pupils better. It is not the result of condition only. It is rather the result of treating a class as one unit than as many individuals. Throughout this book Dr. Hinsdale has had constantly in mind the child *and* the teacher. He argues that an essay or a book on teaching is necessarily a book on studying, and that a book on the art of teaching is equally as useful to a child (who is of the age to understand it) as it is to a teacher. He laments the fact that it is all too common, in text-books of this nature, to put the matter from the teacher's point of view. To a certain extent, of course, this is perfectly right and proper, since instruction that is to help teachers must bring their own distinct and separate art clearly before them. The difficulty lies in this—the teacher's outlook is by far too exclusive. The reader of the book is not made to see, from a pupil's point of observation, the ground that he and the pupil are to occupy in common, and the consequence is, he does not see as he should the pupil's own peculiar difficulties and needs. There can be no doubt that if children could read and understand books which are made for a teacher's guidance, it would be an estimable thing. Whether they could do so is a question. Anyway, this is Dr. Hinsdale's view. To some extent we are bound to say that the reading of this book would impart much to a child—of some understanding. He could not possibly follow in all its paths. It is a book for a scholar.

One of the chief factors in the art of study, as well as in the art of teaching, is that of attention. To this subject Dr. Hinsdale devotes about sixty-four pages, and treats it in a masterly way. To his own thoughts and experience he adds illustrations from our own authors, and quotes, sometimes at considerable length, passages from the writings of well-known and eminent scientists and educationists of all ages and nationalities.

In dealing with things that distract the mind of the child and teacher from the thing in hand, the author deals a blow at school decorations. He thinks that the idea of making beautiful the walls of a schoolroom has been overdone. We do not agree. We think that the more attractive a schoolroom is made, whether it be by pictures, by cases of object-lesson illustrations, models of ships, etc., and the host of other splendid and useful appliances which educational firms in this country have been at such trouble to produce, the more helpful it will be for scholar and teacher alike. These things must be had, and they must be used. Where are they to be stored, if not exposed to view on the walls of the school? Our opinion is that such illustrations exposed in this way do not distract the mind to an appreciable extent. It is the sudden blast of a German band, the cry of the hawker in the street, the grinding of a hurdy-gurdy, and such-like disturbances, that call the mind away.

As a whole, the book comes to us as a welcome addition to our library of pedagogical literature. It contains much that we can brood over, and much that will add to our widening out of ideas. At the close of each chapter a list of books is given for parallel reading. Many of them are of American source, and cover a wide field.

* *The Art of Study. A Manual for Teachers and Students of the Science and Art of Teaching.* By B. A. Hinsdale, Ph.D., LL.D. (American Book Company, New York, Cincinnati, and Chicago.)

OUR TUTORIAL SECTION

OUR PUPIL TEACHERS' AND SCHOLARSHIP COURSE.

BY ARTHUR T. FLUX,

Principal of the Belvedere Pupil Teachers' Centre, First on Scholarship List; Author of "Scholarship School Management," "Building of the British Empire," etc.

SPRING EXAMINATION, 1901.

Tenth Month—February.

WORK TO BE PREPARED.

1. ENGLISH.

Candidates.—*Marmion*, Canto vi., line 1022 to the end.
First Year.—*The Traveller*, line 412 to the end. Twenty roots and meanings each week, and the derivation of all important words in the passage set.
Second Year.—*Julius Cæsar*, Act v., Scene 4 to the end. Common mistakes in written and spoken language. (See *Pupil Teachers' English Notebook*.)

2. COMPOSITION.

Write one or two essays each week, selecting from the following:—*Coal and its Uses; The Life of the Author of the Poem you have been studying; The Advantages of Travelling; "A stitch in time saves nine;" Success, and how it is attained; Our Army and Navy; Spring and Autumn contrasted; Winter Pastimes.*

3. HISTORY.

Candidates.—George III.
First Year.—Edward VI., Mary, and Elizabeth.
Second Year.—William IV., Victoria to 1854.

4. GEOGRAPHY.

Candidates.—Ireland: industries, people, towns, etc.
First Year.—Finish India.
Second Year.—Finish Australia. New Zealand.

5. ARITHMETIC.

All Years.—Practice in problems, etc.

6. EUCLID.

First Year.—Revise Props. 11-20, with six deductions per week.
Second Year.—Revise Props. 27-40, with eight deductions per week.

7. ALGEBRA.

General practice. Pay special attention to factors.

Notes on the Month's Work.

1. ENGLISH.

For full notes see February number, 1900.

2. COMPOSITION.

Of the many essays sent in for competition, the best was that by Miss Gooderham, Diss, Norfolk. The nearest in order of merit were H. Buckle, Diss; M. Burdett, Stonebroom; and E. Sambleson, Fairford. The chief defects observable in the others were (1) an absence of arrangement, (2) an absence of *thought*—that is, the ideas were too childish for pupil teachers. In many cases the sentences were too short and disconnected, bearing evidence that the ideas were jotted down without any attention to the sequence of thought and connection with the preceding and following matter. This lack of sequence is always a grave fault, and arises from not following the advice so often given—that is, to make out a skeleton plan before commencing to write. The following is a "plan" of what should be done. The subject first set for this month—"Coal and its Uses"—is a wide one, and one on which no pupil teacher should be at a loss for ideas.

1. Coal: what it is. Stored up ages ago by decaying forests.
2. Formation of coal deposits in seams or layers.
3. Method of mining.
4. Uses—(*a*) For combustion to obtain heat in homes, for engines, etc.
   (*b*) For the preparation of gas.
5. The by-products—tar, spirit, aniline dyes, etc.—useful in a variety of ways.

It would be impossible to deal with each exhaustively in a couple of pages of foolscap, but a few words should be said on each section.

It is not necessary to make headings for the sections. Commence a new paragraph for each, and incorporate the heading in the first sentence.

3. HISTORY.

Candidates.—The reign of George the Third is a long and very important one. The most important points are:—

1. The conclusion of the Seven Years' War by the treaty of Paris, by which Canada and several of the West Indies were ceded to us.
2. The war with the American colonies.
   Causes—
   (*a*) The selfish commercial policy of England in not allowing the colonies to trade with other countries.
   (*b*) The attempt to tax them without giving representation in the English Parliament.
   Events—
   1765. Stamp Act passed.
   1767. Duties imposed on glass, painters' colours, paper, and tea.
   1770. Repeal of duties, except that on tea.
   1773. Tea thrown overboard in Boston harbour. Boston harbour closed by the Government. Meeting of deputies from all the states.
   1775. Outbreak of war. Battle of Bunker's Hill.
   1776. Declaration of Independence.
   1777. Burgoyne surrendered at Saratoga.
   1781. Cornwallis surrendered at Yorktown.
   1782. Rodney's victory over the French in the West West Indies.
   1783. Treaty of Versailles, giving the colonies independence.
   Results—
   The founding of the United States.
   Great increase in the National Debt.
   Indirectly, the colonising of Australia.

There are several phases to notice in connection with the war—
(1.) Canada, though recently taken, remained loyal, *because* the French Canadians found themselves better off under English than under French rule.
(2.) England stood alone, against all the powers of Europe.
(3.) The European method of fighting was not of much use against the colonists, who were used to Indian warfare.

3. The affair of John Wilkes, who, though a bad man, fought for a good principle—liberty of the press to criticise parliamentary affairs.
4. The Gordon Riots, against the proposed Catholic emancipation.
5. The French Revolution.
6. War of the French Revolution, 1793.
   Events—
   1793. Hood occupied Toulon.
   1794. Howe's victory over the French—"the glorious first of June."
   1797. Victory by Sir John Jervis off Cape St. Vincent.
   1798. Battle of the Nile, which entirely frustrated Napoleon's plans of forming an Eastern empire.

1801. Battle of Copenhagen: Danish fleet destroyed.
1802. The hollow Peace of Amiens.
1803. Outbreak of war.
1805. Battle of Trafalgar, which completely overthrew French plans of invasion.
1806. Berlin Decrees.
1808–1814. The Peninsular War. (Draw a map, and insert names of places mentioned.)
1815. Return of Napoleon. Battle of Waterloo. (Prepare a plan.)

7. Union of Ireland and England.

Candidates should be prepared to answer a question on any of the above points, or to write a brief life of Clive, Wolfe, Hastings, Pitt, Fox, Nelson, Wellington, etc.

Note that this war with France cost England over £600,000,000.

First Year.—Chief Points:—

Edward VI.

(*a*) Social condition of the people. Ket's rebellion.
(*b*) The Reformation.
(*c*) Relations with Scotland. Battle of Pinkie.
(*d*) The question of the succession. Who was Lady Jane Grey?

Mary.

(*a*) Marriage and results. Wyatt's rebellion.
(*b*) The Marian persecution. War with France.

Elizabeth.

(*a*) Note the great difficulties which Elizabeth had to meet, and how they were overcome. No army; no navy. Debased coinage. Religious disputes. No trade. Hostility of France and Spain.
(*b*) Mary Queen of Scots.
(*c*) The Spanish Armada.
(*d*) The Irish revolt.
(*e*) The Poor Laws.
(*f*) East India Company.
(*g*) The great advance in trade and commerce owing to the action of the "sea dogs," Drake, Hawkins, Frobisher, Cavendish, etc.

Second Year.—The chief points in the month's work are:—

(*a*) Catholic Emancipation.
(*b*) The great Reform Bill and its results.
(*c*) The Chartists.
(*d*) Introduction of Penny Postage.
(*e*) The Repeal of the Corn Laws.

Notes on Special History—(continued).

The Affair of John Wilkes.—The terms of the treaty of Paris were not entirely popular. England had been everywhere so successful that it was considered by many a mistake to let off our opponents so lightly. The king in his speech referred to the peace as "honourable;" and this John Wilkes, in his paper, *The North Briton*, said was a lie put into the mouth of the king. He was arrested on a general warrant—that is, a warrant in which no name is specified—and confined in the Tower, but was released. General warrants condemned by the Lord Chief Justice. Wilkes brought an action against the Under Secretary of State, and was awarded £1,000 damages.

It is not infrequently the case that text-books fail to point out why Wilkes was so popular, and why the cry of "Wilkes and Liberty" rang through the land. As a private individual Wilkes was of low character, and many of his writings deserved only the fate they received—burning by the common hangman. But to the people he was the man who dared openly to criticise the Government, and this freedom of speech was the liberty they clamoured for. Wilkes was expelled from the Commons in 1764. In 1768 he was returned for Middlesex, and, on Parliament pronouncing the election void, sent up again and again. He was also elected Alderman of London. Thus a bad man was the means of securing that power to publish debates and criticise the conduct of the Government which is used so very freely to-day.

The American War of Independence.—Before dealing with the war with the colonies, the student should endeavour to get a fairly clear idea as to what these colonies were. It is a natural but quite erroneous idea to imagine them of the same status as our colonies are at the present day. North America then was to a large extent an unknown land. Very few English or French had penetrated west of the Mississippi, and the Pacific coast was very rarely visited. The thirteen states lay along the Atlantic coast from the Bay of Fundy to Florida, and there were very few settlements west of the Alleghanies. These states had been founded under different conditions, and were governed in different ways.

Virginia was the oldest colony, and owed its existence to two trading companies—the London Company, which founded Jamestown; and the Plymouth Company, which had only made two small settlements in New Hampshire when its charter was withdrawn.

The New England States.—The Puritans founded New Plymouth in 1620. Driven from England by intolerance, they were fiercely intolerant themselves, and it is owing to religious disputes and differences that Massachusetts, Rhode Island, Connecticut, and New Hampshire were settled.

Maryland was in 1632 granted by Charles I. to Lord Baltimore. In 1692 it became a royal province.

New York and *New Jersey* were taken from the Dutch in 1664.

North and *South Carolina* were founded in 1663, under the auspices of Clarendon, Shaftesbury, and Locke. An attempt was made to set up a kind of feudal system there, but it did not work. In 1729 the Carolinas became Crown colonies.

Pennsylvania was founded by the Quaker William Penn in 1681.

Each colony was ruled by a governor under the English Parliament, the colonial governments varying considerably in power. There was no connection politically between them, and there was no desire to separate themselves from the mother country. They had gained largely by the Seven Years' War. Their rivals the French had been utterly defeated, and they were naturally grateful to England for what had been done. The chief grievance they had at this time was the restriction placed upon their trade. They were bound down to trade with England, they were expected to take English manufactured goods at whatever price was charged, and they were severely fined for smuggling. As may be imagined, they *did* smuggle goods, and did a large trade with Spain.

They produced large quantities of rice, cotton, and tobacco, and collected and exported furs. As labour had been scarce, England had to some extent supplied it by sending out to the "plantations" felons and convicts, who were handed over to the planters to be treated as slaves. Often, too, people were kidnapped and sold for the same purpose. Thus in the mind of the average Englishman of the day the colonies were the abode of villains or semi-savages, even Johnson saying "that as long as they were *not* hanged they ought to be grateful."

As the Seven Years' War had cost England much money, and the amount of the National Debt (then £130,000,000) frightened politicians, it was thought by the ministry (under Grenville) a fit and proper thing that the colonies should pay some share of the expense which had been entailed for them. Accordingly, in March 1764 a bill was proposed providing for the stricter execution of the trade laws, and proposing a stamp tax—all legal documents to bear stamps varying in amount from 3d. to £10. The colonies promptly objected to—not because they were unwilling to pay their share of the expense, but because such a course was in direct violation of the English motto, "No taxation without representation." In fact, the colonists took up exactly the same ground as those men—Hampden and others—did who opposed the arbitrary taxation of Charles I.

The Stamp Act was passed in 1765, and created much excitement and opposition in the colonies. In July 1765 the Rockingham Ministry took charge of affairs. Nine of the colonies sent deputies to a meeting, at which, though expressing allegiance to the Crown and subordination to Parliament, they claimed as an absolute right "that no taxes be imposed upon them but with their own consent." The Parliament passed a Declaration that they possessed authority to legislate for the colonies "in any case whatever," but repealed the Stamp Act. This was the first contest, and the colonists won.

In July 1766 the Grafton Ministry came into power, and, with a shortsightedness which is inexplicable to-day, proceeded to reopen the contest which had apparently been settled. They imposed duties on glass, red and white lead, painters' colours, paper, and tea, with the object of providing payment for governors and judges, and forming a fund for the protection of the colonies in case of war. This act met with the same strenuous opposition as the Stamp Act. Meetings were held everywhere, and people pledged themselves not to buy any of the taxed articles.

And so affairs stood for some years, the colonists gradually hardening in their opposition as they recognised the inability of the Parliament to enforce their laws. In 1770 Lord North repealed the previous duties, excepting a tax of 3d. per pound on tea. This, instead of pacifying the colonists, rendered them more than ever determined to pay *no* tax; and when in 1773 three tea ships arrived in Boston harbour, they were boarded by a number of men disguised as Indians, who threw 340 chests of tea overboard. Other tea ships were refused admission at New York and Philadelphia.

To punish the colonists, the Government decided in 1774 that the harbour of Boston should be closed, and the government of Massachusetts remodelled, thereby depriving the colonists of any share in the government; and British troops under General Gage were stationed in Boston.

In return, all the colonies sent deputies to a congress at Philadelphia, at which they reasserted the illegality of taxing them, and decided to have no commercial dealings with Great Britain. In spite of Burke's eloquent appeal to abolish the tax and leave the colonies alone, the Parliament decided on enforcing their obnoxious proposals by force of arms.

In 1775 Gage attempted to seize cannon and ammunition at Salem, and later a skirmish occurred at Lexington.

(To be continued.)

4. Geography.

Candidates.—Note the unimportance of manufactures owing to absence of coal. The difference between Ulster and the rest of Ireland is due to the fact that the inhabitants of the former are descended largely from English and Scottish settlers. The lace-making industry has recently been revived.

First Year.—Great care must be taken with the preparation of India. It is not one country, but many; not one people, but many. The British occupation has, since the Mutiny, been of the greatest assistance. The Government has made railways, roads, telegraph lines, lighthouses, breakwaters, irrigation works, founded schools and colleges, introduced medical and sanitary reform, administered law and justice impartially. Left to themselves, the princes of India would be continually fighting each other; under British rule there has been, except on the frontiers, continual peace.

Many industries have been introduced or developed—for example, cultivation of tea, cotton, coffee, jute, indigo, poppy (for opium), oil seeds, etc.

The government requires especial attention. We rule directly about 1,000,000 square miles, native princes about 750,000 square miles.

India is not a colony, but a dependency

The government:—

(*a*) In England—Secretary of State and council of men who have lived in India.
(*b*) In India—1. The Governor-General—Lord Curzon.
2. The Executive Council of seven (including the Commander-in-Chief).
3. The governors of other provinces when the Supreme Government meets there.
4. Fourteen members who assist in law-making, etc., but are permanent members.

The above is known as the Supreme Government.

India is divided into thirteen local governments:—

1. Madras; 2. Bombay—under Governors.
3. Bengal; 4. North-West Provinces, with Oude; 5. Punjab; 6. Burmah—under Lieutenant-Governors.
7. Assam; 8. Central Provinces; 9. Berar; 10. Ajmere Merwara; 11. Coorg; 12. British Baluchistan; 13. Andaman Islands—under Chief Commissioners.

These provinces are again divided into districts, each under a Collector, Magistrate, or Deputy Commissioner (of these there are 250), who is responsible for law, order, finance, etc.

Native States number about 650, of which only 200 are important. In most cases the native ruler is assisted by a resident or financial adviser. The amount of absolute power allowed to each ruler varies with the state.

Second Year.—The Federation of Australia must, of course, receive special attention. (Draw a map for each colony, inserting all names to be remembered.)

Test Questions.

1. *English.—Candidates.*

(1.) Analyse the following:—

"Lord Marmion started from the ground,
As light as if he felt *no* wound,
Though in the action burst the tide
In torrents from his wounded side.
'*Then it* was truth!' he said."

(2.) Parse words in italics.

(3.) Give the meaning of *bartisan, leaguer, paladin, rowel, portcullis, targe,* and *palfrey.*

(4.) Explain:—

"And in the chief three mullets stood."

"Flodden had been Bannockburn."

"To moated Lichfield's lofty pile."

"My basnet to a prentice cap,
Lord Surrey's o'er the Till!"

"By Archibald won in bloody work,
Against the Saracen and Turk."

(5.) Define nominative case, infinitive mood, passive voice, and give illustrations from the poem.

First Year.

(1.) Analyse the following, and parse words in italics:—

"*Still may* thy blooms the changeful clime endure!
I *only would repress* them *to secure;*
For just experience tells, in *every* soil,
That those who think *must* govern those who toil."

(2.) Give in your own words Goldsmith's idea of the English character.

(3.) Give the meaning of the prefixes in the following words, and give two other examples of each: *repress, transmit, disproportioned, depopulation, submissive, procession, sympathetic, extols.*

(4.) Write a brief life of Goldsmith, and say who were his chief friends.

(5.) In what metre is *The Traveller* written? Quote four lines, and mark the accents.

Second Year.

(1.) Analyse the following, and parse words in italics:—

"But *'tis* a common proof
That lowliness is young ambition's ladder,
Whereto the climber-upward turns his face;
But when he *once* attains the upmost round,
He then unto the ladder turns his back,
Looks in the clouds, *scorning* the base degrees
By which he did ascend."

(2.) Explain the following:—"I have some aim;" "the posture of your blows;" "orts and imitations;" "men cautelous;" "set our battles on."

(3.) By whom, to whom, and on what occasions were the following lines uttered?—

(*a*) "This was the noblest Roman of them all."
(*b*) "The last of all the Romans."
(*c*) "In Parthia did I take thee prisoner."
(*d*) "I trouble thee too much, but thou art willing."
(*e*) "Oh! he sits high in all the people's hearts."
(*f*) "I know where I will wear this dagger, then."

(4.) Write a character of Brutus *or* Cassius, illustrating your statements by quotations.

(5.) Say what you can of the date of composition, and the sources from which Shakespeare obtained his information.

2. *History.—Candidates.*

(1.) Give an account, with a plan, of any one of Marlborough's victories.

(2.) What attempts did the Stuarts make to regain the throne of their ancestors?

(3.) Say what you can of the South Sea Bubble.

First Year.

(1.) What led to the battle of Flodden? Describe it, giving a plan.

(2.) What events led to the downfall of Wolsey?

(3.) What advance did the Reformation make in the reign of Henry the Eighth?

Second Year.

(1.) Explain the importance of Nelson's victories at the Nile, Copenhagen, and Trafalgar.

(2.) Give an account, with sketch-map, of the Peninsular War.

(3.) Say what you can of the state of England at the end of George the Third's reign.

Next month a complete test examination will be given.

AUTUMN EXAMINATION, 1901.

Fourth Month.

WORK TO BE PREPARED.

1. READING AND RECITATION.

Continue oral practice in these subjects before a competent critic. Something more than mere verbal exactness is required.

2. ENGLISH.

Candidates.—Marmion, Canto vi., lines 351–443, with knowledge of all allusions, etc.

First Year.—The Traveller, lines 145–190, with knowledge of roots, allusions, etc.

Second Year.—Julius Cæsar, from Act ii., Scene 1 ("I am not well in health"), to the end of Act ii. The derivations of all important words, the meaning of allusions, etc., must be thoroughly prepared.

Composition.

Send up essays occasionally for criticism. A good style of composition is of the greatest importance in all written examinations. Prepare a skeleton plan before writing. It is a good practice to read the essay *aloud* when finished. The ear will often detect weaknesses which the eye misses.

Subjects for the month:—*Birds; A Day at the Seaside; The Races of Mankind; Any Walk you have taken; "A bird in the hand is worth two in the bush;" Fairy Tales.*

Several of these will need reading up before being attempted.

3. HISTORY.

Candidates.—Edward I., Edward II., Edward III., and Richard II.

Chief Points:—

Edward I.

(*a*) Legal measures.
First Statute of Westminster.
Quo Warranto Inquiry.
Statute of Mortmain (very important).
Second Statute of Winchester—minor but very important police regulations.
Statute of Quia Emptores—to prevent subinfeudation of land.
(*b*) Conquest of Wales, and the Statute of Wales.
(*c*) Judicial Reforms. The overcrowded Courts of Justice divided into—(1) Court of Exchequer, (2) Court of Common Pleas, (3) Court of King's Bench, with an adequate staff of judges to each.
(*d*) The war with Scotland. Prepare a table to illustrate descent of claimants.

Edward II.

(*a*) The king's favourites—Gaveston and the Despensers.
(*b*) The Lords Ordainers.
(*c*) Events leading up to the battle of Bannockburn. (Prepare a plan of the battle.)
(*d*) Deposition and death of the king.

Edward III.

(*a*) The Hundred Years' War. Note the causes of this—the alliance of French and Scots, French raids on the south coast, the rising of the Flemish wool towns against the Count of Flanders, and the intervention of the French king. The latter was the *real* cause. Edward's claim (quite a futile one) was put forward to secure some of the wavering vassals in the north of France.

Battles of Crecy and Poictiers (prepare plans), and treaty of Bretigny.

(*b*) The Black Death, Statutes of Labourers, and the effects upon the villeins.

(*c*) Statute of Provisors—against the Pope making appointments in the English Church.

Statute of Treason—limiting the application of the term to certain acts.

Statute of Præmunire—against appeals to Rome.

(*d*) Black Prince in France.

(*e*) Declining years of the king.

Richard II.

(*a*) The Peasants' Revolt (this is most important, and must be carefully prepared): causes and effects.

(*b*) The king's minority.

(*c*) Period of Absolute Rule. Deposition and death.

First Year.—Edward I. and II. (as above).

Second Year.—Charles II. A reign distinguished by selfish legislation, by dissolute life at court, by repression of Nonconformists, and a general rejection of the Puritanical yoke.

1. The Clarendon Code.
2. The Dutch War. Contrast the conduct of this with that under Cromwell. (Read Pepys' *Diary* for a peep behind the scenes.)
3. The Great Plague and Great Fire.
4. The Secret Treaty of Dover. England to help France against the Dutch, Charles to receive £300,000 per annum and restore Roman Catholicism. The most scandalous treaty ever signed for England.

4. Geography.

Candidates.—England: the southern counties.

First Year.—Denmark, Norway and Sweden, Holland and Belgium.

Second Year.—Finish and revise the whole of Africa. An account of the present war must be carefully prepared.

5. Arithmetic.

Candidates.—General exercises and problems in fractions.

First Year.—Compound proportion. Work in *three* lines by method of unity.

Second Year.—Discount. The meaning of the terms must be thoroughly understood.

6. Euclid and Algebra.

First Year.—Euclid—Props. 9–12, and two deductions per week.

Algebra—Multiplication; harder examples, with literal coefficients.

Second Year.—Euclid—Props. 39–42, with four deductions per week.

Algebra—Multiplication and division of fractions. Use factors wherever possible.

7. Music.

Candidates.—Whole-pulse and half-pulse notes, continuations, and rests.

First Year.—Thirds of a pulse.

Second Year.—Relative pitch of keys.

8. Teaching.

All Years.—Continue regular practice in writing on the blackboard.

Test Questions.

1. *Penmanship.*—*All Years.*

Large Hand:—*Mithridates.*

Small Hand:—*The sports of children satisfy the child.*

2. *English.*—*Candidates.*—Analyse lines 257–264, *Marmion*, Canto vi., and parse *perchance, tell, featly, peace to teach, best, rest.*

First Year.—Paraphrase lines 99–110, *The Traveller.*

Analyse lines 99–104, and parse *let, try, as, for a while, cares, resigned, like, yon.*

Second Year.—Paraphrase Brutus's speech commencing, "No, not an oath."

Analyse as far as "redress," and parse *oath, be, betimes, enough to kindle, what need be, our own.*

3. *History.*—*Candidates.*

(*a*) Give an account of the conquest of Ireland. Was it a "conquest"?

(*b*) Explain clearly what led to the passing of the Constitutions of Clarendon.

(*c*) What events led to the signing of the Magna Charta? What were its chief provisions?

(*d*) In what respect did De Montfort's Parliament differ from those preceding it?

First Year.

(*a*) Enumerate, with a sketch-map, Henry the Second's possessions.

(*b*) Explain Romescot, Interdict, Excommunication, Scutage.

(*c*) Give an account of England during Henry the Third's minority.

(*d*) Write about twenty lines on De Montfort's Parliament.

Second Year.

(*a*) Describe the different forms of government from 1642 to 1660.

(*b*) Say what you can of Cromwell's foreign policy.

(*c*) Give some account of the reduction of Ireland.

(*d*) Explain clearly what took place between Cromwell's death and the return of Charles the Second.

4. *Geography.*—*Candidates.*

(*a*) What are the chief industries of England, and where are they carried on? Arrange your answer in tabular form.

(*b*) Give a full account, with sketch-map, of Yorkshire.

First Year.

(*a*) What do you understand by the term Germany? Give an account of its government.

(*b*) What are the chief industries of Italy? How do you account for its comparatively low condition among the Great Powers?

Second Year.

(*a*) Say what you can of the West Coast possessions.

(*b*) Describe the course of the proposed Cape to Cairo Railway. What portions of it are completed? Illustrate with a sketch-map.

5. *Method.*—What is the best way of correcting dictation exercises?

SCHOLARSHIP EXAMINATION, 1901.

Second Month.

Work to be Prepared.

1. *Reading and Repetition.*—Ten minutes' practice daily in oral work, and as much general reading of good literature as time will allow.

2. *Penmanship.*—Ten minutes daily (*Practical Teacher Copy Book*), with attention to the subject at all times.

3. *Dictation.*—One or two passages per week.

4. *Theory of Teaching.*—Chap. ii., *Scholarship School Management.*

5. *Geography.*

(1.) India.

(2.) Revise Russia, Austria, and Switzerland.

6. *English.*

(1.) The grammar and syntax of the adjective.

(2.) Twenty-five roots and meanings per week.

(3.) The history of the language. Results of the introduction of Norman French.

(4.) *Julius Cæsar*, to the end of Act i.

7. *History.*—Henry II. to Henry III. (inclusive).

8. *Composition.*—One or two essays each week, on such subjects as:—The Commonwealth of Australia; The Feudal System; Insects, and their Use to Man; Criticism of any book recently read; The Value of Time; Modern Warfare; Description of any historical building or ruins; The Proper Use of Time; A Pupil Teacher's Daily Life.

9. *Arithmetic.*—Vulgar fractions.

10. *Algebra.*—Fractions (use factors wherever possible).

11. *Euclid.*—Book II., Props. 5–8, and four deductions each week.

12. *Elementary Science.*—Mechanical powers. Heat and energy.

13. *Languages.*
Latin—Prepare pars. v., vi., vii., viii., *Life of Miltiades* (PRACTICAL TEACHER edition). Revise pronouns.
French—Gender of nouns. Four chapters from *Le Roi des Montagnes*, or equivalent amount from any similar book.

14. *Drawing.*—A freehand copy each week.

15. *Music.*—Chap. ii., *School Music Teacher.*

16. *Domestic Economy.*—Classification of foods. Nutriment contained. Dietaries. Methods of cooking. Respiration and Ventilation (pp. 95-122, Nelson's *Domestic Economy*).

Notes on the Work for the Month.

1. *Geography.*—A note on the government of India is given above. Industries, towns, imports, exports, etc., require attention.

Copy into notebooks and learn the following:—

Area—1,750,000 square miles, 750,000 square miles being under native rulers.

Population—300,000,000.

Total Revenue—£67,500,000. Chief sources—Land tax, opium, salt, stamp, excise, post office, state railways.

Total Expenditure—£64,000,000. Chief objects—Administration (salaries, etc.), railways, irrigation works, buildings and roads, army.

(Note that India is a *poor* country; with seven times the population of England and thirty times the area, the annual income is smaller.)

Imports (in order of value)—Cotton goods, metals, oils, sugar, railway plant, machinery, woollen goods, provisions, liquor, hardware, etc.

Exports (in order of value)—Rice, hides and skins, seeds, cotton, tea, opium, jute, wheat, indigo, wool, coffee, lac, teak, etc.

Largest Cities (population in thousands)—Calcutta (978), Bombay (821), Madras (452), Hyderabad (415), Lucknow (273), Benares (219), Delhi (192), Mandalay (188), Cawnpore (188), Bangalore (180), Rangoon (180), Lahore (176), Allahabad (175), Agra (168), Patna (165), Poona (161), Jeypore (158).

Chief Religions—Hindu (97 millions), Mussulman (27 millions), Buddhist (3½ millions), Animistic (3½ millions), Christian (2 millions), Sikh (1 million), Jain (½ million), Parsee (50,000), Jews (10,000).

The following questions have been asked in former examinations:—

1. Draw an outline map of India, showing rivers and watersheds.

2. Give a short account of the climate and productions of, and the chief towns in, the district between the Eastern Ghauts and the Bay of Bengal.

3. Write notes of a lesson on the inhabitants of India.

4. Give a summary of what you know about India, under these heads—(*a*) size; (*b*) climate, with special reference to rainfall; (*c*) mountains.

5. Into what three portions does the peninsula of Hindustan physically divide itself? State very briefly some physical characteristics of each portion, and name in each portion three towns which are not seaports.

6. Say what you can of the rivers and rainfall of Northern India.

7. Give an account, with sketch-map, of the basin of the Ganges or Indus.

8. What manufactures and exports of India have lately developed most? What are the chief reasons for the development?

9. Explain as concisely as you can how India is governed.

10. What influence have the Himalayas on the climate of Hindustan?

11. Give a general description of the islands belonging to England in the Indian Ocean, dealing particularly with their inhabitants, and their importance as trade centres.

12. What do you know of the following:—Elephanta, Ghoorkas, Sikhs, Plassey, Tinnevelly, Taj Mahal, Peshawur, Khyber Pass, Simla, Great Indian Desert, Mandalay, Andamans?

13. What are the monsoons? Account for the periodic rise of the Indus and Mahanuddy.

2. *English.*—Learn a good classification of adjectives, with exact definitions. Be prepared to answer such questions as:—

(1.) Make a list of adjectives compared irregularly.

(2.) What adjectives do not admit of comparison?

(3.) Distinguish between *further* and *farther*, *older* and *elder*, *inferior* and *lower*, *later* and *latter*; and give examples of adjectives of the comparative form where there is no positive used.

The results of the Conquest on the language are most important. The following are some:—

(*a*) Introduction of new words.
(*b*) Loss of inflections in English words, especially verbs and adjectives.
(*c*) Auxiliaries more widely used.
(*d*) Presence of synonyms—*acknowledge* and *confess*, *childish* and *puerile*, etc.—one being the English and one the Norman French.
(*e*) Loss of the power of compounding to form new words.
(*f*) Loss of many Saxon words.

In the *Julius Cæsar*, students are invited to write in case of any difficulty. The whole should be analysed and paraphrased, and all words presenting difficulty parsed.

3. *History.*—In studying the history a regular plan should be adopted. The work is largely revision, but the student is expected to show more reasoning power and to possess a wider knowledge. The following plan will be found useful:—

(1.) Learn the dates of the chief events *thoroughly*.
(2.) Read up the reign from the text-book and any other history available. (Green's *Short History*, Macmillan, is a most useful additional book.)
(3.) Analyse into notebook, looking at each event—(*a*) the cause, (*b*) the incident itself, (*c*) the result.
(4.) Draw and learn plans of battles, maps to illustrate position of place; prepare lives of chief men.
(5.) Note also the chains of events running through history—for example, the Church and State: (*a*) Investiture Dispute, (*b*) Constitutions of Clarendon, (*c*) Mortmain, (*d*) Præmunire, (*e*) Provisors, (*f*) De Heretico Comburendo, (*g*) Statute of Six Articles, (*h*) Reformation, etc. So also with decay of Feudal System, rise of Commons, etc.

Remember history is a long chain of cause and effect. To know the facts without this is comparatively useless. What I mean is this. Any pupil teacher will know that Wat Tyler's rebellion took place in 1381, that he killed a tax-collector, marched on London, and was killed, etc. But this is trivial compared with the *causes* which produced the rising—villenage, French wars, Black Death, Statutes of Labourers, heavy taxation, etc.; and the *results*—abolition of villenage, substitution of money rent for personal service, etc.

4. *Composition.*—Continual care will be needed with this subject. Students will find it of assistance to send up one essay per month for criticism.

5. *Arithmetic.*—As this is mainly revision work, extra time should be given to the theory and to harder examples. If the student can do all the exercises in Christian and Collar, there is nothing to fear in the examination.

6. *Algebra.*—Proofs of the rules must be learned—multiplication, division, etc. The whole of the exercise on Miscellaneous Fractions in Hall and Knight should be worked.

Test Questions.

1. *Penmanship.*

Large Hand:—*Patronymic.*
Small Hand:—*Milton! thou shouldst be living at this hour; England hath need of thee.*

2. What is mind? Say what you can of the presentative faculties.

3. Point out the importance of Gibraltar, Malta, Aden, Singapore, and Hong Kong as trade depots. Make a table showing area and population of each, and the time it takes to reach them from London.

4. What are the chief manufactures of Germany, and where are they carried on?

5. Distinguish the various uses of the objective case, and give examples.

6. Analyse the following, and parse words in italics:—

"*That* you do love me I am *nothing jealous;*
What you *would* work me to I have *some* aim;
How I have thought of *thee* and of these times
I shall recount hereafter."

7. What do you know of the social life of the Normans?

8. What is the least number which when divided by 33 leaves 32 remainder, when divided by 37 leaves 36, and when divided by 43 leaves 42? Ans. 52502.

9. Define a gallon. Given that a cubic inch of water weighs 252·458 grams, find the capacity of a gallon in cubic inches.
Ans. 227·274 cubic inches.

10. Find the G.C.M. of $x^4 - 3x + 20$ and $5x^4 - 3x^3 + 64$.
Ans. $x^2 - 3x + 4$.

11. Find the L.C.M. of $6x^3 - 6$, $4x^3 - 8x + 4$, $3x^3 + 6x + 3$.
Ans. $12(x^3 - 1)^2$.

12. Explain the process of digestion.

(The answers to these test questions are marked and criticised at a nominal charge of one shilling.)

CORRESPONDENCE: RULES.

To ensure an answer in the next issue, queries must be sent by the 15th of each month.

Name and address of sender, with coupon of current number of THE PRACTICAL TEACHER (and *nom de plume* if desired), must be enclosed.

As a rule, all replies will appear in the Correspondence Column; but any one desiring an immediate reply may obtain it by enclosing a stamped addressed envelope.

All communications and queries with regard to the PUPIL TEACHERS' AND SCHOLARSHIP COURSE should be addressed to "Mr. A. T. FLUX, The Bays, Belvedere, Kent."

ANSWERS TO CORRESPONDENTS.

Agnes.—A good essay, 17/20. Your writing needs attention.

H. B. W.—I will give next month a list of such books as you need.

(*Other correspondents answered by post.*)

OUR CERTIFICATE COURSE FOR 1901.

BY GEORGE COLLAR, B.A., B.SC.,

Head-Master of the Stockwell Pupil Teachers' School.

TEST QUESTIONS ON LAST MONTH'S WORK.

THEORY OF TEACHING.

SECOND YEAR.—1. Distinguish between Material Fallacies and Logical Fallacies, and give examples of the chief varieties of each.

2. Draw up a list of twenty object lessons suitable for Standard III., to be given between the summer holidays and Christmas.

3. Prepare notes of lessons on—
(*a*) Sulphur.
(*b*) Mice.
(*c*) Wood: kinds and uses.

ARITHMETIC.

BOTH YEARS.—1. What premium must be paid to insure a ship worth £16,500, on the covered insurance plan, at 1½ per cent.?

2. If a florin is worth 23·8d., and a franc worth 9·5d., divide £45, 11s. among three people so that the number of sovereigns, florins, and francs they would respectively receive if paid in those coins shall be equal.

ENGLISH GRAMMAR AND LITERATURE.

FIRST YEAR.—1. Give a summary of the subject-matter of *Sohrab and Rustum*.

2. Discuss the changes which took place in the English language between 1066 and 1485.

SECOND YEAR.—1. Give a summary of the remarks on the Salic law in *Henry V.*

2. Give an account of Macaulay's election for Edinburgh in 1853.

GEOGRAPHY.

BOTH YEARS.—1. Draw a sketch-map of the West India Islands, to illustrate the history of the conflict in them.

2. Write an account of the manufactures of Germany. How do you account for their recent great development?

HISTORY.

BOTH YEARS.—Discuss the importance of the West Indian colonies during the wars of the French Revolution. What steps were taken to secure and extend British influence in the West Indies?

ALGEBRA.

WOMEN—BOTH YEARS.—1. Solve—

$$\begin{cases} 8x + 4y - 5z = 6 - 2z. \\ 2x + 3y - z = 7 + x. \\ 4x - y + 4z = 8 + 4y. \end{cases}$$

2. Half the sum of two numbers is 24, and half their difference is 17. Find them.

MEN—FIRST YEAR.—1. Multiply $a^n + ba^{n-1}x - ca^{n-2}x^2$ by $a^m - ba^{m-1} + ca^{m-2}x^2$.

2. Prove that if $\sqrt{a}$ and $\sqrt{x}$ are irrational, and $\sqrt{a} + b = \sqrt{x} + y$, then $b = y$ and $\sqrt{a} = \sqrt{x}$.

MEN—SECOND YEAR.—1. In how many years will a sum of money double itself at 5 per cent. compound interest [log 2 = 3010300]?

2. If log 4 = 6020600, and log 26 = 1·4149733, find the logarithms of 16, 25, 1·3, and $(1{\cdot}69)^{10}$.

FRENCH.

BOTH YEARS.—1. Which verbs of the fourth conjugation omit the "t" of the third person singular of the present indicative?

2. Give the indicative, present and preterite, of *croire*, *croître*, *naître*, and *plaire*.

3. Translate into French:—

The return of the robin is commonly announced by the newspapers, like that of eminent or notorious people to a watering-place, as the first authentic notification of spring. And such his appearance in the orchard and garden undoubtedly is. During the severe drought a few years ago, robins wholly vanished from my garden. I neither heard nor saw one for three weeks.

4. Translate into English:—

Notre séjour à Potsdam est une académie perpétuelle. Je laisse le roi faire le Mars tout le matin, mais le soir il fait l'Apollon, et il ne paraît pas à souper qu'il ait exercé cinq ou six milles héros de six pieds; ceci est Sparte et Athènes; c'est un camp et le jardin d'Epicure; des trompettes et des violons, de la guerre et de la philosophie. J'ai tout mon temps à moi; je suis à la cour, je suis libre; et si je n'étais pas entièrement libre, ni une énorme pension, ni une clef d'or qui déchire la poche, ni un licou qu'on appelle cordon d'un ordre, ni même les soupers avec un philosophe qui a gagné cinq batailles, ne pourraient me donner un grain de bonheur. VOLTAIRE.

SYLLABUS AND NOTES FOR FEBRUARY.

ENGLISH COMPOSITION.

Prepare essays on the following subjects:—
1. Compulsory Military Service.
2. Punctuality.
3. Winter Amusements.

THEORY OF TEACHING.

SECOND YEAR.—Some of our readers have asked for further explanation of "the essential characters of the 'Cartesian method,'" in consequence of the question in the December number. We therefore include the following remarks in this month's notes, as they were too late for the January issue. The "Cartesian method" is so called because it is based upon a "Discourse" of Descartes (1596–1650), *Discours de la Methode pour bien conduire sa raison et chercher la verité dans les sciences.* This was first published in 1637 at Leyden, where the author was staying. It consists of six parts. In the first the writer makes some general observations on the nature of knowledge; in the second he gives the principal rules that he has worked out for the acquisition of knowledge; in the third and fourth he shows the results which follow in morals and religion from his methods; and in the fifth and sixth he gives some applications of them to natural science, especially physiology. It is on the second of these parts that our attention should be chiefly fixed. Having stated how he had been led to consider what are the guiding principles in studying a subject, he states that it is possible to reduce them to four, which he himself has followed.

"1. The first was, not to accept anything as true which I did not know by evidence to be so; that is to say, to avoid carefully haste and prejudice, and to include nothing more in my judgments than what presented itself to my mind so clearly and distinctly that I had no room for doubt about it.

"2. The second, to divide each of the difficulties which I was

examining into as many small parts as was possible, and as was necessary for the better solution of them.

"3. The third, to conduct my thoughts orderly by beginning with the simplest and easiest objects, in order to rise little by little, as by steps, up to a knowledge of the most complicated, and by supposing some sort of order even among the things which do not naturally precede one another.

"4. And the last, to make always such complete enumerations and such general reviews that I was certain I had not omitted anything."

We do not think that the criticism of Jevons on the first of these rules (see Jevons, ch. xxvii.) has much weight. There is a great difference between refusing to believe a statement which is evidently untrue, and accepting as true one which is not known to be contrary to actual facts. This first rule does not oblige us to believe in the existence of "mountains of gold or oceans of fresh water." In fact, the fact that gold is such a precious metal does give us ample room to doubt the existence of whole mountains of it within an accessible distance; and with regard to the existence of such masses in a far-off planet, the rule allows us with equal power to assent to or deny it.

Read Jevons, Lessons xxiv.–xxix., paying particular attention to analysis and synthesis, and also to the proper use of "examples." Notice the conditions under which a general law may be proved by the consideration of a particular case.

The student will now be in a position to consider the true bearing of the fundamental rules of teaching, which, in the light of the studies hitherto followed, will be no longer mere "catch-words," but full of intense meaning. He is advised to read carefully the chapter on "The General Principles of Instruction" in Collar and Crook's *School Management*, and, if possible, to read H. Spencer's book on *Education*.

Arithmetic.

Profit and Loss.—We mentioned last month that custom sanctioned the use of the term per cent., in speaking of profit and loss, without stating the quantity of which it is a percentage, because it was always understood that profits and losses are represented as percentages of the cost price. But even in this case we would advise our readers to make a point of using the complete phrase, "per cent. of C.P." This will greatly simplify those examples which deal with articles passing through several hands. Remember that we cannot add or subtract percentages of different quantities.

Example:—A tradesman, who professed to sell his goods at 25 per cent. under cost price, explained that what he called cost price was really 30 per cent. above it, and that he expected to clear 5 per cent. profit. Find (1) what percentage he really gained or lost, (2) what was the amount of gain or loss on goods which he sold for £92, 12s. 6d. (Certif. 1890.)

Here S.P. = 75 per cent. of nominal C.P.

$= \frac{75}{130}$ of 130 per cent. of actual C.P.

$= 97\frac{1}{2}$ per cent. of actual C.P.

∴ he loses $2\frac{1}{2}$ per cent. of actual C.P.

There is only one step required in working the next part; for the selling price is $97\frac{1}{2}$ per cent. of the C.P., and the loss is $2\frac{1}{2}$ per cent. of the C.P.—that is, $\frac{2\frac{1}{2}}{97\frac{1}{2}}$ of the selling price.

$$\frac{2\frac{1}{2}}{97\frac{1}{2}} \text{ of £92, 12s. 6d.} = \frac{1}{39} \text{ of £92, 12s. 6d.} = \underline{\text{£2, 7s. 6d.}}$$

English Grammar and Literature.

First Year.—Study the influence of French on the English language. This is shown (*a*) in the inflections, (*b*) in the terminations, and (*c*) in the vocabulary.

(*a*) In countries where the language is highly inflected, the common people tend to drop them, while the upper classes—the educated people—act as guardians of the inflections. After the Conquest most of the educated people spoke French, and hence the majority of the Anglo-Saxon inflections were lost. The use of *s* as the sign of the plural in nouns is due to French influence.

(*b*) Several of our suffixes which are generally regarded as Latin were fixed upon the language by Norman influence—for example, *ance*, *ant*. The latter is the French participial ending, and Early English verbs adopted it too; but the only ending of the present participle which has remained is *ing*, and words ending in *ant* have become adjectives—for example, *pleasant*.

(*c*) The vocabulary has been enriched by the addition of many new words. (See Nesfield.)

Lyra Heroica, cxiii.–cxxvi.

cxiv.—*Laverock*—that is, the skylark. *Ousel* = the blackbird. *Throstle* = the song-thrush.

cxviii.—*Ayont the faem.* Across the sea.

Weird = a fate; destiny.

Thole = to suffer.

To dree = to endure.

A waefu' gift gie they = they give us a pitiful present.

A'thing = everything.

cxix. *Reveille*, the bugle-call for the soldiers to get up in the morning.

cxxi.—*Carackes*, ships of war; literally, *cargo* ships.

Flaccus, the Latin poet generally known as Horace. Lord Howard of Effingham, who commanded the English fleet against the Spanish Armada, was a great admirer of the *Odes* of Horace.

Drake was born in Devon.

Hawkins bowl rubbers. The story of the game of bowls which was in progress when the Armada came in sight is well known.

St. James is the patron saint of Spain. The Spanish for James is Jago. Sant Jago or Santiago = Saint James.

cxxii.—These beautiful lines refer to General Gordon, who was killed at Khartoum in the vain endeavour to maintain the authority of Egypt against the Dervishes.

cxxv.—*Calkins.* The calkins are the little projecting pieces at the back of a horse-shoe. Indian horse-stealers have been known to take the shoes off the horses they steal and reverse them, so that any one finding their track would think they had gone the other way.

Second Year.—Read to the end of Macaulay's *Life and Letters.*

Study in detail the third act of *Henry V.*

Prologue.—15. *Rivage*, shore or bank. (Lat. *ripa*, the bank.)

18. That is, fix your attention and let it follow the ships.

Scene i. 11. *Like the brass cannon.* Supply "pry through the portholes of a ship."

14. *Swilled* = washed. The word properly means to wash dishes, and is allied to "scullery."

18. *Fet* = fetched.

27. *Mettle*, vigour or spirit. It is really another form of "metal," and in the early editions of Shakespeare no distinction is made in the spelling.

Antics, silly fellows. (Lat. *antiquus;* hence *antic*, an old man.)

> "Within the hollow crown
> That rounds the mortal temples of a king
> Keeps Death his court, and there the *antic* sits."
> *Richard II.*

White-livered. The liver was supposed to be the seat of cowardice, and cowardly people were supposed to have pale livers.

104. *Lig*, lie: a northern word, from the Scandinavian.

The officers introduced at the end of Scene ii. represent different parts of the kingdom, and the peculiarities of their speech should be noticed.

29. *Whiles*, an adverb formed from the genitive case of the noun "while," a time.

Harfleur, on the north side of the mouth of the Seine, is now eclipsed by the modern town of Le Havre.

Scene v. 7. *Scion*, an offshoot or *graft.* The *stock* is the trunk on which it is grafted.

9. *Grafters.* The metaphor seems mixed. Shakespeare probably means the trees from which the grafts were originally taken, not the men who did the grafting.

14. *Nook-shotten*, full of corners or angles.

19. *A drench for sur-reined jades*, a medicinal draught for overworked horses.

Their barley-broth—that is, ale. The Constable could not understand how the English could derive such energy from beer.

39. *More sharper.* Double comparatives and double superlatives were fairly common in Shakespeare's time.

52. *Rheum*, fluid (from Gr. *rheo*, I flow).

60. *For achievement*, to settle the matter; to bring it to a head. (Lat. *caput*, the head.)

Ransom, a doublet with *redemption.*

Scene vi. 38. *Pax*—that is, a pix or pyx, the box in which the consecrated bread is reserved.

56. *Figo*, a fillip of the fingers; a snap. We now say "a fig."

115. *Our cue.* The cue is the ending of a speech. Actors must know the last words of the speech before their own, so as to come in at the proper time. These words form the "cue" (from Fr. *queue*, the tail).

Pasterns, the narrow part immediately above the hoof of a horse.

20. *Elements.* Used in the sense of the old alchemists, who thought that everything was composed of earth, air, fire, and water in different proportions.

23. *Jades.* This word did not always imply want of spirit in a horse. Shakespeare applies it to the horses of the sun, which had so much fire that Phaethon could not control them.

> "Down, down I come; like glistering Phaethon,
> Wanting the manage of unruly jades."
> *Richard II.*, Act iii. Scene 3.

49. *Kern*, an Irish soldier. The word is Celtic.

History.

Both Years.—We dealt last month with the course of the struggle in the West Indies, because it formed a part of the war by itself, as it were. We shall now see how the conflict was carried on in other parts of the world.

Owing to the bad harvest in France in 1793, and the importation of food-stuffs being prevented by the allies by land and sea, the French Government collected a large convoy of laden merchantmen in the United States ports, and decided to bring them to France under the escort of five ships of war. A squadron of five ships of the line and some lighter vessels, under Admiral Nielly, and a larger one of 25 ships, under Admiral Villaret, left Brest to cruise in the Atlantic and assist the convoy, but with orders not to fight unless obliged. On May 2 the Channel fleet, consisting of 34 ships of the line and 15 frigates, left Spithead with 148 merchantmen. Off the Lizard, eight of the warships went south with the merchantmen, under Admiral Montagu, with orders to convoy them as far as Cape Finisterre, and then cruise in the Bay of Biscay to intercept the French convoy. Lord Howe took the other vessels out into the Atlantic in search of the fleet under Villaret, with which he came up on May 28. Fighting commenced on the afternoon of that day; but the French continued their journey towards the south-east, their rear ship, the *Révolutionnaire*, being engaged with two or three English ships, one of which, the *Audacious*, was so crippled that it could take no further part in the fighting. On the 29th the two fleets continued their course, Lord Howe trying to get to windward of the French; and in the fighting attending this manœuvring the French ship *Indomptable* was so damaged that she had to retire from the fleet and make for Brest. During the 30th of May action was prevented by a fog; but Nielly's squadron joined the French fleet, which thus numbered 26, in good condition, to Howe's 25. The next day both fleets continued their course, and Howe was not in a position to force on an engagement before night. The next morning the two fleets were in parallel lines, and after breakfast the English, being to windward, bore down on the French. The fight was stubbornly contested; the French sailors fought well, but their gunnery was inferior. Seven of their ships were captured, and the rest greatly damaged; the English fleet also suffered much damage. We must here refer to the part played in the battle by the *Vengeur*. In attempting to pierce the French line the British ship *Brunswick* collided with the *Vengeur*, and the two vessels became so entangled that they drifted away together side by side. The guns in the upper part of the *Vengeur* were superior to those opposed to them in the *Brunswick*, but below the case was reversed, as the French could not open their portholes to use their lower-deck guns after the collision. After an hour another French ship, the *Achille*, though much damaged, came to the relief of the *Vengeur;* but a few shots from the *Brunswick* brought down her only remaining mast, and she drifted away, and was captured. For two hours longer the vessels remained connected, and then, as they got clear, the *Brunswick* poured in some parting shots, which destroyed the *Vengeur's* rudder and increased her fatal leaks. The *Brunswick* was then so damaged that she stood off to the north. The *Vengeur* received a passing volley from the *Ramillies*, which was on her way to capture the dismasted *Achille*. The *Vengeur* was now fast sinking; pumps were worked, guns thrown overboard, and signals of distress were made. At 6 p.m. two British ships that were near sent boats to the rescue, and brought off about 400 survivors; the remainder, including many badly wounded, went down with the ship. The *Vengeur's* crew had fought bravely, and cries of "Vive la Republique" were heard from those who were on her when she sank; and it is a pity that the real bravery of the crew has been obscured by the exaggeration in the speech of Barrère in the National Convention.

The decisive part of the fighting took place on the 1st of June, and hence the engagement is spoken of as the "glorious first of June." The French fleet suffered a severe defeat, but Villaret accomplished his object of saving the great convoy by drawing the British fleet away from its track; and it arrived safely in Brest on June 14, in company with the remainder of Villaret's ships, which met it just outside the harbour.

Geography.

Both Years.—Study the details of the geography of *Holland and Belgium*.

The build is simple: fairly high ground, the Ardennes, to be found in the south and south-east; the rest flat and low. The lower courses of several rivers are found here. Study the mouths of the Rhine. The main stream enters Holland at Emmerich, and is then called the Waal. About half-way to the sea this is joined by the Maas (Meuse). Soon after entering Holland a smaller branch is given off on the right bank, which is called the "Rhine," and this in turn gives off a branch—the Yssel—which runs past Zutphen and Kampen into the Zuyder Zee. (See note on Salic law in last month's English.) The part called the Rhine continues its course westward, and after giving off another branch on the right bank, continues, under the name of the Leck, past Rotterdam into the North Sea. The branch keeps the name of Old Rhine, and flows past Utrecht and Leyden, and enters the North Sea at Katwyk. In the last part of its course, the country through which it flows is so low that immense flood-gates have been constructed at Katwyk to prevent the tide from the sea coming up the river and overflowing the land. These gates are opened only when the tide has nearly reached its lowest point, when the river water that has collected is allowed to run into the sea. The coast is bordered by sand-hills, called dunes, on which a reedy kind of grass is grown, which retains the fine sand blown on to it by the wind. The whole formation is sandy, alluvial soil. Notice the marshy lakes. Some have been drained, and their beds now form rich pasturage. Perhaps the finest example of a drained lake or "polder" is that of Haarlem-meer, which is several feet below sea-level, and is kept dry by numerous windmills which pump water into dikes with which it is intersected, and which lead northwards to Halfweg, where large steam pumps drive the water into two great canals, one of which runs east into the Zuyder Zee at Amsterdam, and the other westwards past Haarlem into the North Sea. The moist, sandy soil of the polder is admirably adapted for the growth of tulips and other bulbs, which are exported in enormous quantities. Contrast the occupations of Holland and Belgium. In Holland, agriculture, particularly dairy-farming, fishing, diamond-cutting, and distilling. The distilleries of Schiedam, between Rotterdam and Delft, are the largest in the world, and innumerable pigs are fattened on the refuse. In Belgium, owing to the rich supplies of minerals, manufactures are important, and include the coarser sorts of iron goods, machinery, and steel. Note the great manufacturing towns in the valleys of the Sambre and Meuse.

The commerce of both countries is important. The inland trade is done largely by canals; the foreign passes mostly through Antwerp and Ostend for Belgium, and through Rotterdam, Amsterdam, and Harlingen for Holland. Flushing, on the island of Walcheren, has a great passenger traffic with England.

Algebra.

Women—Both Years.—Problems involving equations with more than one unknown. A very common type of problem in this class deals with numbers of two or more digits. Remember that if x and y are the tens and units digits respectively, the real value of the digit in the tens place is $10x$, so the number is $10x + y$, and, similarly, the number formed by reversing the digits will be $10y + x$.

Men—First Year.—Work examples on surds. It is not necessary, as a rule, to work out the square root of an expression involving surds by the method shown in the text-books. If possible, arrange the expression in the form of $a^2 + 2ab + b^2$. This is best done by considering the factors of the term involving the surd.

Find the square root of $9 + 2\sqrt{14}$.

Since $2\sqrt{14}$ has to be put in the form of $2ab$, ab must represent $\sqrt{1} \times \sqrt{14}$, or $\sqrt{2} \times \sqrt{7}$; and as 9 must equal the sum of the squares of these factors, the first pair of values is inadmissible; hence

$$\sqrt{9 + 2\sqrt{14}} = \sqrt{7} + 2\sqrt{7}\sqrt{2} + 2 = \sqrt{7} + \sqrt{2}.$$

Similarly,

$$\sqrt{13 - 2\sqrt{30}} = \sqrt{10} - 2\sqrt{10}\sqrt{3} + 3 = \sqrt{10} - \sqrt{3}.$$

Men—Second Year.—Scales of notation.

Euclid.

Women—First Year.—Revise to end of Prop. 15, and work deductions.

Women—Second Year.—Revise to end of Book I., and work six deductions at least per week.

Men—First Year.—Revise Book II.

Men—Second Year.—Revise Book III., Props. 1-15, with deductions on these propositions.

Any difficulties may be sent up.

French.

Both Years.—Study the grammar of the pronouns.

Finish *Le Voyage autour de ma Chambre*, with the exercises at the end.

LONDON MATRICULATION.

JUNE 1901.

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LATIN COURSE FOR FEBRUARY.

1. Sallust, *Catiline*, chap. 57 to the end. Revise chaps. 1–15.
2. Grammar.—Learn the verbs of the third conjugation that are irregular in the perfect and supine. In the syntax, use of subjunctive in principal sentence; note how questions are asked in Latin; the rules for the sequence of the tenses of the subjunctive; the difference in the uses of the tenses of the indicative in Latin and English; the uses of the negatives. Revise the uses of the cases and the declensions again. The nouns of the third declension especially should be learned again and again, monotonous though the task may be.
3. *Anglicè Reddenda*, Nos. 58–68.
4. Sentences from Bradley's *Arnold* or Bayfield's or Allen's *Exercise Book*.

Notes on Grammar.

Know the different uses of *haud*, *non*, and *ne* to express "not." *Ne* is used in wishes and prohibitions; *haud* is normally used before adjectives and adverbs. Note, however, the use of *haud* with a verb in the phrase *haud scio an*, "I am inclined to think." The various interrogative particles used in asking questions are important.

Distinguish the different methods of translating "whether .....or." In a question use *utrum.....an*. Remember that "whether.....or" in an adverbial clause is translated by *sive .....sive*. In some cases it is hard to tell whether the clauses are adverbial or not. The best test is this: if you can take away the "whether.....or" clause and leave the sense complete, then the "whether.....or" clause is adverbial; if, however, the absence of the clause would leave the sense incomplete, then the clause is an interrogative one. Note the differences between *num*, *ne*, and *nonne* in asking questions. Remember that *an* is not used in the first portion of disjunctive questions. Where *an* apparently is used in this way, there is always an ellipsis of the first alternative. When *dum* is used in the sense of "while," not in the sense of "during the whole time that," the present indicative is always used; the use of the imperfect indicative is incorrect—for example, *dum haec in colloquio geruntur, Caesari nuntiatum est equites Arioviști accedere*. Even in oratio obliqua we find *dum* with the present indicative.

Postgate notices some cases in which the tense of the indicative in Latin differs from the tense in English. *Postquam* is followed by the perfect indicative, instead of the pluperfect, if the exact time after is not mentioned—for example, "After he had said this, we went away," *Postquam hoc dixit, abivimus*. Again, after the words *si*, *cum*, *donec* (until), etc., when the principal verb is in a future tense, the future simple is used in Latin, when the time of the actions expressed by the principal sentence and the dependent sentence is the same—for example, *hoc faciam cum potero*—we say, "I shall do this when I can." *Hoc faciam cum possum* would be bad Latin. If, however, the action of the dependent clause is antecedent to that of the principal clause, use the future perfect indicative in the dependent clause—for example, *non respondebo donec tacueris*, "I shall not answer till you are silent." Here the silence begins before the answer is made, and as the verb of answering is in the future, the verb of silence will be in the future perfect.

The rule for the sequence of tenses must be thoroughly known and applied. I need not lay stress on the fact that knowing a rule is one thing and applying it is another. There is perhaps no rule which is so often disregarded, even by men who have been a considerable time at Latin. I have often alluded to it in the sentences; I shall, however, sum it up again. This rule regulates the tenses of the subjunctive to be used in dependent clauses. If the verb in the principal clause is in a secondary or historical sense—that is, the imperfect, pluperfect, aorist perfect—the imperfect or pluperfect subjunctive is to be used. If the principal verb is in a primary tense—that is, present future, future perfect, present perfect, and imperative—use either the present or perfect subjunctive.

There are one or two additional rules dealing with the sequences which, I think, will prove useful in case a sentence involving them should be given in the Matriculation. If the verb which the subjunctive depends is in the historical present, the primary or secondary sequence can be used—the former because the historical present is present in form; the latter because, logically, the present here is equivalent to a past tense, and therefore the same tenses of the subjunctive can be employed as if an historical tense were used in the principal clause. If the subjunctive clause precedes the clause in which the historical present is, the secondary sequence is regular. Examples—*Persuadet Castico ut regnum occuparet* (*occupet*), "He persuades (= persuaded) Casticus to seize supreme power;" but, *Reliquas copias Helvetiorum ut consequi posset, pontem in Arare faciendum curat*.

When a subjunctive clause depends on an infinitive which, if used in the indicative, would have been a secondary tense, the verb in the subjunctive must be either in the imperfect or pluperfect—for example, "I know that Cæsar told you why we did this," *Scio Caesarem tibi dixisse cur hoc fecissemus*. Here *dixisse* represents in oratio recta, *Caesar tibi dixit*, and *dixit* is a secondary tense; therefore the secondary sequence is required for *fecissemus*. Again, the perfect subjunctive in Latin, like the perfect indicative, may be either a primary or a secondary tense—for example, "I know why you asked me to do this," *Scio cur me rogaveris ut hoc facerem*. Here *rogaveris* represents a secondary tense, therefore you must use in the subjunctive clause dependent on it the imperfect or pluperfect subjunctive; but, on the other hand, note that *Scio cur me rogaveris ut hoc faciam* is correct when it represents in English, "I know why *you have asked* me to do this," as *rogaveris* in this case is a primary tense, and therefore requires primary sequence.

In *consecutive clauses*, or clauses expressing a result, there may be a case when the sense of the phrase does not allow the application of the rule for the sequence of tenses. It may happen that a *past action* has as its result a *present fact*, and in this case the present or perfect subjunctive can be used. Such cases, however, are not very commonly given in an elementary examination. It is, however, well to be prepared for contingencies.

Typical Sentences.

22. "The brave Cicero would have threatened to put to death all the most seditious citizens if the general had informed you of the disaster at Athens."

Cicero vir fortis se civium seditiosissimum quemque interfecturum minatus esset si imperator de clade Atheniensi te certiorem fecisset.

Notes.—(*a*) "Would have," in a principal sentence, is rendered in Latin by the pluperfect subjunctive, if "would have" implies a condition that has not been carried out; and if the "if" sentence is expressed, the verb in that sentence will be either in the pluperfect or imperfect subjunctive. Hence here we have *fecisset*, and not *fecerat*. (*b*) *Minor*, as explained before, is followed by the accusative and future infinitive. (*c*) Note the phrase for "to inform." The adjective *certior* agrees with the object of *fecisset;* as the object here is *te*, *certiorem* is used. (*d*) "Of," depending on a verb where you could substitute "about," is generally expressed by *de*, and not by the genitive—for example, "I talk of this man" is *de hoc loquor*, not *huius loquor*. (*e*) Note *Cicero vir fortis*, not *fortis Cicero*. (*f*) "All the," followed by a superlative adjective, is expressed by a superlative adjective and *quisque*. *Quisque* follows the adjective.

23. "If each of you were to stop a fortnight in Syracuse and thirteen days or more in Delos, you would not be satisfied."

Si vestrum quisque Syracusis quatuordecim dies et Deli tredecim vel plures dies maneat, non sitis contenti.

Notes.—(*a*) "Would," in a principal clause implying a condition, is expressed by (1) the present subjunctive, if the action refers to the future; (2) by the imperfect subjunctive, if the action refers to the present or to the past. Here the action refers to the future. Now in the "if" clause the subjunctive must be used if the verb in the principal clause is subjunctive, and the tense of the subjunctive will be the same as that in the principal clause. Hence in the sentence we write *sitis*. (*b*) A fortnight was a division not known to the Romans, therefore use *quatuordecim dies*. (*c*) "More" will have to be plural, agreeing with *dies*.

24. "I say that your uncle would not have helped such sailors as these if word had been brought to him to the effect that the town was taken."

Nego avunculum tuum his talibus nautis subventurum fuisse si ei oppidum captum esset nuntiatum.

Notes.—(*a*) Here "would have" occurs in a sentence which in Latin has to be expressed in the accusative and infinitive, as it depends on a verb of saying. Therefore the pluperfect subjunctive is not admissible, but the future participle with *fuisse* is used instead; hence *subventurum fuisse* is used above. (*b*) When in English we use a verb of saying, followed by a negative "that" clause,

we must not express this in Latin by *dico* followed by a negative infinitive clause, but use *nego* and a positive infinitive clause. The literal translation of the sentence given above is, "I deny that your uncle would have helped." (*c*) The subjunctive *nuntiatum esset* is due to the rule given in sentence 19, as *subventurum fuisse* represents *subvenisset* in oratio recta. (*d*) *Captum*, the perfect infinitive, is used, as the action of *captum* is antecedent to that of *nuntiatum esset*. (*e*) "Such sailors as these" = "these such sailors." (*f*) *Subvenio* governs the dative.

26. "I should like him to ask your father what would have happened if the town had not been devastated by the general."

Velim patrem tuum roget quid eventurum fuerit nisi oppidum ab imperatore vastatum esset.

Notes.—(*a*) "I should like," expressed by present subjunctive *velim*, is followed by the subjunctive without *ut* when the subject of the following verb is *not* the same, and by the infinitive when the subject of the following verb is the same. "Would have," in dependent, interrogative, and consecutive sentences, (1) if the verb is active, is expressed by the periphrastic perfect subjunctive; (2) if the verb is passive, by the gerundive, with the perfect subjunctive of *sum*. Hence here we have *eventurum fuerit*. (*b*) *Vastatum esset* is used according to the rule in sentence 19. The verb on which it depends would, if not dependent on *roget*, have been written *evenisset*. The change of *evenisset* to *eventurum fuerit*, necessitated by its dependence on *roget*, will not, of course, affect the mood and tense of *vastatum esset*.

Sentences for Practice.

(Readers can have their solutions corrected by sending them to Editor Matriculation Course, *P.T.*, and enclosing 7 stamps.)

Turn into Latin:—

1. It seems that all of you were too wise to run away to the city of Capua.
2. It is said that we can prevent him from selling these books for 25 sesterces apiece.
3. Who ordered each of the soldiers to sell the sailors 10 pecks of corn at 4 sesterces a peck?
4. We can send them word at once to the effect that the citizens have repented (*poenitet*) of their crimes.
5. The brave Claudius received a mortal (*mortifer*) wound while fighting with the enemy not far from Capua.
6. It is doubtful whether he will persuade your friend to do this, or be himself persuaded to remain neutral (*neutri favere*).
7. At the age of forty the illustrious Nero died, and was buried in Syracuse, a city which was thirty miles distant (*absum*).
8. We might have killed such a coward (*ignavus*) as this man without being punished.
9. I know he would never have attacked the enemy without ascertaining (*cognosco*) how numerous they were.
10. They ought not to have made it their aim to (*id agere ut*) spare these men without asking you if it were wise to form this design (*consilium*).

Test Paper.

(Readers can have their solutions corrected by sending them to Editor Matriculation Course, *P.T.*, and enclosing 7 stamps.)

1. Give the gender, accusative singular, and full plural of *pellis, cinis, tussis, hilaris, vetus, cassis, calcar, calx, pondus, grandis.*
2. Parse and give the meaning of *regnanto, peperi, verebere, expergiscere, nise, afuit, prodis, iace, fugem.*
3. Give the cardinal numbers from twelve to twenty, the ordinals from 16th to 23rd, and the distributive and numeral adverbs from six to sixteen.
4. What are the principal parts of *pungo, bibo, avello, nitor, digero, consuesco, ordior, edo, constituo, invideo,* and *fido?*
5. What prepositions are required in the following phrases:—Word for word; do this for me; about a hundred; for the present; in Livy; by Jove; in the meantime; at the foot of the hill; towards night; in front of the camp; according to nature; about the first of May?
6. Turn into passive construction—*Iudimus; mater puellae librum dat; te sententiam rogamus; eum capitis damnavit.*
7. Put into oratio obliqua—*Hostes ego neque vici neque vincere volui; tuum est eorum urbem expugnare.*

Put into Latin:—(1.) This has happened thrice in the last few days. (2.) None of you pity us. (3.) The angry consul ordered them to be put to death. (4.) He is well spoken of by all the best people.

ARITHMETIC COURSE.

Chapters xxix., xxx., and xxxi. of Pendlebury.

Solution to example:—

3 lbs. of tea at 2s. a lb. cost 6 shillings.

4 lbs. of tea at 3s. a lb. cost 12 shillings.

∴ the 7 lbs. cost 18 shillings.

To gain 5 per cent., what costs 100 shillings is sold for 105.

∴ what costs 18s. is to be sold for $\frac{18 \times 105}{100}$, or $\frac{189}{10}$ shillings.

∴ the selling price is $\frac{1}{7}$ of $\frac{189}{10}$s., or $2\frac{7}{10}$ shillings per lb.

Examples:—

1. A man sells an article for £112, 10s., gaining 20 per cent.; what percentage would he have gained if he had sold it for £130?
2. At what rate per cent. will £1303, 6s. 8d. amount to £1884, 18s. 11d. in seven years at simple interest?

GEOMETRY COURSE.

Read Book III. to the end of Prop. 30.

Solutions to riders:—

1. Let C be the centre of the circle, and P the given point.

Through P draw a chord QPR perpendicular to CP. This will be the least chord required, for let APB be any other and draw CD perpendicular to it. Then, in triangle CDP, CDP being a right angle is larger than angle CPD; hence CP is larger than CD, and therefore, by III. 15, chord AB is greater than chord QR.

2. Let PQ be given straight line, and A and B the two given points. Bisect AB at C, and draw CN perpendicular to AB, meeting PQ in N. Then a circle centre N and radius NA will be the one required.

Riders:—

1. In a circle, through a given point inside it to draw a chord equal to a given straight line not greater than the diameter of the circle.
2. If a quadrilateral circumscribe a circle, prove that the sum of one pair of opposite sides is equal to that of the other pair.

ALGEBRA COURSE.

Chapters xxv. and xxvi. of Hall and Knight.

Solution to example:—

Let x and y be the digits, so that the numbers are $10x + y$ and $10y + x$.

Difference of squares of numbers

$$= (10x + y)^2 - (10y + x)^2$$
$$= 100x^2 + 20xy + y^2 - 100y^2 - 20xy - x^2$$
$$= 99(x^2 - y^2) \text{ as required.}$$

Examples:—

1. Find whether any value of x can make the expressions $x^5 - x^4 - 2x^3 + 2x^2 - 3x + 3$, and $x^3 + x^2 - 3x - 3$, both equal to zero.
2. Solve $8x - \frac{12}{x} = 5$ to two places of decimals.

SCIENCE COURSE.

In Science, chapter xii. of the Mechanics portion, and chapters v. and vi. of the Chemical portion, of Briggs and Bryan's *General Science.*

In Loney's *Mechanics*, chapters v. and xv., and a revision of the Hydrostatics.

1. Sum to infinity $1 + (\sqrt{3} - 1) + (4 - 2\sqrt{3}) + \ldots$, working to three decimal places.

Second term ÷ first term $= (\sqrt{3} - 1) \div 1 = \sqrt{3} - 1$.

Third term ÷ second term $= \frac{4 - 2\sqrt{3}}{\sqrt{3} - 1} = \frac{(4 - 2\sqrt{3})(\sqrt{3} + 1)}{(\sqrt{3} - 1)(\sqrt{3} + 1)}$

$$= \frac{2\sqrt{3} - 2}{2} = \sqrt{3} - 1.$$

∴ it is a geometrical progression whose common factor is $\sqrt{3} - 1$.

Sum to infinity $= \frac{a}{1 - r} = \frac{1}{1 - (\sqrt{3} - 1)} = \frac{1}{2 - \sqrt{3}}$

$$= \frac{2 + \sqrt{3}}{(2 - \sqrt{3})(2 + \sqrt{3})}$$
$$= \frac{2 + \sqrt{3}}{1}$$
$$= 2 + 1{\cdot}732 \text{ to 3 places}$$
$$= 3{\cdot}732.$$

2. Find the twelfth term of an arithmetical progression whose first and third terms are $2x - 3y$ and $5y - 2x$.

By formula, n^{th} term $= a + (n - 1)d$.

$$5y - 2x = 2x - 3y + 2d.$$
$$\therefore 2d = 8y - 4x.$$
$$\therefore d = 4y - 2x.$$

Twelfth term $= a + 11d$

$$= 2x - 3y + 11(4y - 2x)$$
$$= 41y - 20x.$$

3. If the sum of the digits of any number be divisible by 9, prove that the number itself is also divisible by 9.

Let $xyz \ldots qr$ be the $n+1$ digits of a number so that $x + y + z + \ldots + q + r$ is divisible by 9.

The number $= 10^n x + 10^{n-1} y + 10^{n-2} z + \ldots + 10q + r$
$= (10^n - 1)x + (10^{n-1} - 1)y + (10^{n-2} - 1)z + \ldots$
$+ (10 - 1)q + x + y + z + \ldots + q + r.$

Now $10^n - 1$ is divisible by $10 - 1$—that is, by 9.

$10^{n-1} - 1$ is also divisible by 9, etc.

∴ the number is divisible by 9, if $x + y + z + \ldots + q + r$ is so divisible.

4. If $\frac{p}{q}$ be a positive proper fraction, find whether it be greater or less than $\frac{p+x}{q+x}$, x being positive.

$$\frac{p}{q} = \frac{pq + px}{q(q+x)},$$
$$\frac{p+x}{q+x} = \frac{pq + qx}{q(q+x)}.$$

Since $\frac{p}{q}$ is a proper fraction, q is larger than p.

∴ qx is larger than px.

∴ $pq + qx$ is larger than $pq + px$.

∴ $\frac{p+x}{q+x}$ is larger than $\frac{p}{q}$.

5. Simplify $\frac{x^3}{(x-y)(x-z)} + \frac{y^3}{(y-z)(y-x)} + \frac{z^3}{(z-x)(z-y)}$.

$$\text{Expression} = -\left[\frac{x^3}{(x-y)(z-x)} + \frac{y^3}{(y-z)(x-y)} + \frac{z^3}{(z-x)(y-z)}\right]$$
$$= -\frac{x^3(y-z) + y^3(z-x) + z^3(x-y)}{(x-y)(y-z)(z-x)}.$$

In numerator put $x = y$. It then $= y^3(y-z) + y^3(z-y) + 0 = 0$.

∴ $(x-y)$ is a factor.

Similarly, $(y-z)$ and $(z-x)$ are also factors.

Now the numerator has four algebraic factors; it has therefore one more, which must be symmetrical.

∴ it is $x + y + z$.

∴ $x^3(y-z) + y^3(z-x) + z^3(x-y)$
$= k(x-y)(y-z)(z-x)(x+y+z)$.

Take $x = 1$, $y = 2$, $z = 3$.

∴ $1(-1) + 8(2) + 27(-1) = k(-1)(-1)(2)(6)$.

Or $12k = -12$—that is, $k = -1$.

∴ expression $= -\frac{-(x-y)(y-z)(z-x)(x+y+z)}{(x-y)(y-z)(z-x)}$
$= x + y + z.$

Erratum.—We regret to state that an incorrect solution to the problem, "The sum of £1640 is to be paid back by two equal annual payments allowing 5 per cent. compound interest; find the annual payment," appeared in one of our back courses. The correct solution is to be found amongst the Answers to Queries in this issue.

QUERY COLUMN.

RULES.

1. Each correspondent is restricted to *one* question.
2. Each query must be accompanied by the name and address of the correspondent, and the *coupon* which appears on the back wrapper of the current number of the Journal.
3. CORRESPONDENTS MUST IN ALL CASES STATE THE SOURCE FROM WHICH THEIR QUERY HAS BEEN OBTAINED.

The Editor reserves to himself the right to decline to answer any question which is, in his judgment, unsuited to the Magazine.

Thankee.—We think you should apply to a "photographic" journal for the information you require. Send to the editor of *Amateur Photographer*, Creed Lane, London, E.C., or to editor of *Practical Photographer*, Percy Lund, Amen Corner, E.C.

To-day.—The printed solution to which you refer is unfortunately incorrect, and so is your solution. The following we consider to be correct:—

The lender pays down £1640 on the condition that at the end of one year he shall receive a sum of £P, and at the end of two years another sum, also of £P. That is, £1640 is equal to the present value of a sum £P, due in one year, together with the present value of a sum £P, due in two years, compound interest at five per cent. per annum being taken.

Now the present value of £P, due in one year, is £v, where

$$v + \frac{5}{100}v = \text{P},$$
$$v\left(1 + \frac{1}{20}\right) = \text{P},$$
$$v = \text{P} \div 1\tfrac{1}{20} = \frac{20}{21}\text{P}.$$

Let the present value of a sum £P, due in two years, be v_1.

Then in one year v_1 amounts to $v_1 + \frac{1}{20}v_1$, or $\frac{21}{20}v_1$.

Then in two years v_1 amounts to $\frac{21}{20}v_1 + \frac{1}{20}$ of $\frac{21}{20}v_1$
$= \frac{21}{20}v_1\left(1 + \frac{1}{20}\right)$
$= \left(\frac{21}{20}\right)^2 v_1.$

Hence $\left(\frac{21}{20}\right)^2 v_1 = \text{P},$
$v_1 = \text{P}\left(\frac{20}{21}\right)^2.$

Therefore $1640 = v + v_1 = \text{P} \cdot \frac{20}{21} + \text{P}\left(\frac{20}{21}\right)^2 = \text{P}\frac{20}{21}\left(1 + \frac{20}{21}\right)$
$= \frac{20}{21} \cdot \frac{41}{21}\text{P}.$

∴ $\text{P} = 1640 \times \frac{21 \times 21}{20 \times 41} = \underline{\text{£882.}}$ Ans.

F. Horton.—By selling goods at £51, 16s. a ton, I should gain 25 per cent. if it were not for a waste of 2 per cent. What profit should I make on the sale of $40\frac{1}{4}$ tons?

If there had been no loss, the seller must have paid (£51, 16s.) $\times \frac{100}{125}$ per ton.

The 2 per cent. waste has the same effect as if the seller, when buying one ton, only got $\frac{98}{100}$ of one ton; so that he really paid £51, 16s. $\times \frac{100}{125} \times \frac{100}{98}$ per ton.

Hence, on each ton which he sells he gains—

£51, 16s. − £51, 16s. $\times \frac{100}{125} \times \frac{100}{98}$
$= £51, 16s.\left(1 - \frac{100 \times 100}{125 \times 98}\right) = £51, 16s.\left(\frac{9}{49}\right).$

Therefore, on $40\frac{1}{4}$ tons he gains—

$$\frac{161}{4} \times \frac{9}{49} \times £51, 8s. = £382{\cdot}95 = £382, 19s.$$

Richmond.—If, for the range of values of x between 0 and 2π, $f(x) = a_0 + a_1 \cos x + b_1 \sin x + a_2 \cos 2x + b_2 \sin 2x + \ldots + a_r \cos rx + b_r \sin rx + \ldots$ show that

$$a_r = \frac{1}{\pi}\int_0^{2\pi} f(x) \cos rx\, dx,$$

$$b_r = \frac{1}{\pi}\int_0^{2\pi} f(x) \sin rx\, dx, \text{ and find } a_0.$$

Obtain the series of this type, which is equal to $x(2\pi - x)$ between the limits 0 and 2π of the variables.

(Lond. B.Sc., 1899.)

To find a_r, multiply both sides of the given equation by $\cos rx$; call this equation (2). Integrate throughout (2) between limits 0 to 2π. The integral of each term on the right, except that of $a_r \cos^2 rx$, is zero. For example—

$$\int_0^{2\pi} a_0 \cos rx\, dx = \left[\frac{a_0}{r} \sin rx\right]_0^{2\pi} = \frac{a_0}{r}(\sin 2r\pi - \sin 0) = 0.$$

$$\int_0^{2\pi} a_1 \cos rx \cos x\,dx = \int_0^{2\pi} \frac{a_1}{2}\left[\cos(r+1)x + \cos(r-1)x\right]dx$$

$= 0$, by above. Hence (2) becomes

$$\int_0^{2\pi} f(x)\cos rx\,dx = \int_0^{2\pi} a_r \cos^2 rx\,dx = \int_0^{2\pi} \frac{a_r}{2}(1+\cos 2x)\,dx$$

$$= \int_0^{2\pi} \frac{a_r}{2} + 0 = a_r\pi.$$

Therefore $a_r = \frac{1}{\pi}\int_0^{2\pi} f(x)\cos rx\,dx.$

Similarly for b_r.

Hence we see, by integrating the given equation, that

$$\int_0^{2\pi} f(x)\,dx = \int_0^{2\pi} a_0\,dx + 0 = 2\pi a_0.$$

That is, $a_0 = \frac{1}{2\pi}\int_0^{2\pi} f(x)\,dx.$

Or a_0 is the average height of that part of the curve, $y = f(x)$, included between $x = 0$ and $x = 2\pi$.

Since $f(x)$ is given as $x(2\pi - x)$, and a_0, a_1, b_1, etc., in terms of definite integrals are now known, the series is readily obtained. In determining the values of the definite integrals, the method of integration by parts is employed when the integral takes the form of $\int x^n \cos rx\,dx$, or $\int x^n \sin rx\,dx$.

D.T.S.—Show that, under circumstances to be determined, the moment of a system of coplanar forces can be the same about all points in their plane.

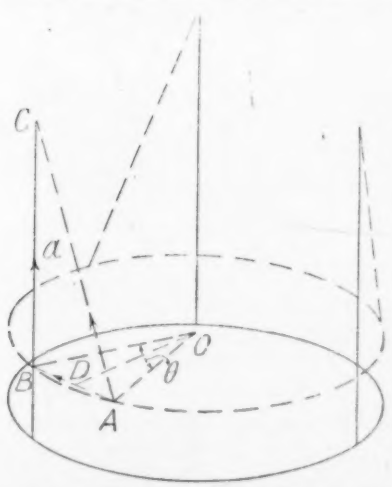
A circular ring of radius a and weight W is suspended in a horizontal position by three vertical threads, each of length l, attached to points on its circumference; prove that, in order to hold the ring horizontal and twisted through an angle θ, a horizontal couple must be applied to it equal to

$$W\frac{a^2\sin\theta}{\left(l^2 - 4a^2\sin^2\frac{\theta}{2}\right)^{\frac{1}{2}}}.$$

Prove that the small angular oscillations of the ring are approximately simple harmonic, and that their periodic time is the same as that of a simple pendulum of length l.

(London Int. Sc., 1900.)

Omit one force, and find the resultant of those which remain. If the line of action of the omitted force be parallel



to (but not coincident with) that of the resultant just mentioned; if also the *senses* of these two forces be *opposite;* and, further, if their magnitudes be equal, then under such circumstances the system of coplanar forces will reduce to a couple.

It is unnecessary to show here that the moment of a couple is the same about any point in the plane of the forces.

The figure shows the ring, first, suspended by three vertical strings, and then rotated about its centre through an angle θ; so that the strings occupy the inclined positions indicated by the dotted lines. Of course the ring is raised in consequence.

From *each* string there is a force T acting on the ring. The three vertical components support the mass W lbs., or

$$3T\cos\alpha = W.$$

The three horizontal components, when multiplied by the perpendicular OD, produce the couple tending to restore the ring to its position of equilibrium, or

$$\text{Restoring couple} = M = 3T\sin\alpha \,.\, a\cos\frac{\theta}{2}$$

$$= W\tan\alpha \,.\, a\cos\frac{\theta}{2}$$

$$= W\frac{AB}{BC}\,.\,a\cos\frac{\theta}{2}$$

$$= W\frac{2a\sin\frac{\theta}{2}}{\sqrt{l^2 - \left(2a\sin\frac{\theta}{2}\right)^2}}\,.\,a\cos\frac{\theta}{2}$$

$$= \frac{Wa^2\sin\theta}{\sqrt{l^2 - 4a^2\sin^2\frac{\theta}{2}}}.$$

If θ be small, $M = Wa^2\theta \div l$

—that is, the restoring moment is proportional to θ, the angular displacement; therefore, when oscillatory motion takes place, it will be simple harmonic.

The periodic time is—

$$t = 2\pi\sqrt{\frac{\text{angular displacement}}{\text{angular acceleration}}}$$

$$= 2\pi\sqrt{\frac{\theta}{\text{restoring moment} \div \text{moment of inertia}}}$$

$$= 2\pi\sqrt{\frac{\theta}{\frac{Wa^2\theta}{l} \div \frac{W}{g}a^2}}.$$

$$t = 2\pi\sqrt{\frac{l}{g}},$$

which is the result for a simple pendulum of length l.

Plodder.—The ends of a glass cylinder are worked into convex spherical surfaces whose radii are equal to the length of the cylinder, and whose centres are at the ends of the axis of the cylinder. Prove that the geometrical focus of a pencil, after direct refraction through the ends of the cylinder, is determined by the equation

$$\frac{\mu^2}{v} - \frac{1}{u} = -\frac{\mu^2 - 1}{r}.$$

(Aldis, *Geometrical Optics*, p. 89, Ex. 5.)

This problem is incompletely expressed, since no mention is made of the point or points from which u and v must be measured. The above formula will hold only in the case where both v and u are measured from that end of the cylinder on which the light is first incident.

Let u = distance of object, to right of right-hand surface of lens; v_1 = distance of image formed on refraction through right-hand surface of lens, measured to the right from that surface.

Then, since the radius of curvature of that surface will be equal to $-r$ (it is convex to the right, and distances measured to the left must be given a negative sign), we have

$$\frac{\mu}{v_1} - \frac{1}{u} = \frac{1-\mu}{r}.$$

$$\therefore \mu ru - rv_1 = (1-\mu)uv_1.$$

$$\therefore v_1\{(1-\mu)u + r\} = \mu ru. \quad . \quad . \quad . \quad . \quad . \quad (1)$$

Turning our attention now to the refraction at the left-hand surface of the lens, we see that the image formed at the first refraction, which is at a distance v_1 to the right of the right-hand surface of lens, will be at a distance $v_1 + r$ to the right of the left-hand surface.

Let v = distance of image finally formed, measured to the right from right-hand surface of lens.

Then the distance of this image from left-hand surface of lens will be $v + r$. Remembering that in passing from glass to air the refractive index will be $\frac{1}{\mu}$, and that the radius of curvature of the left-hand surface will be $+ r$, we have for the second refraction

$$\frac{\frac{1}{\mu}}{v + r} - \frac{1}{v_1 + r} = \frac{\frac{1}{\mu} - 1}{r},$$

$$\frac{1}{v + r} - \frac{\mu}{v_1 + r} = \frac{1 - \mu}{r}.$$

Simplifying, we get

$$v_1\{r - (1 - \mu)(v + r)\} = rv. \quad . \quad . \quad . \quad . \quad (2)$$

Eliminating v_1 by dividing (1) by (2), we get

$$\frac{r + (1 - \mu)u}{r - (1 - \mu)(v + r)} = \frac{\mu u}{v}.$$

$$rv + (1 - \mu)uv = \mu ru - \mu(1 - \mu)(v + r)u$$
$$= \mu ru - uv\mu(1 - \mu) - ur\mu(1 - \mu).$$
$$\therefore rv + (1 + \mu)(1 - \mu)uv - \mu^2 ru = 0.$$

Dividing through by uvr, we get

$$\frac{1}{u} + \frac{1 - \mu^2}{r} - \frac{\mu^2}{v} = 0.$$

$$\therefore \frac{\mu^2}{v} - \frac{1}{u} = -\frac{\mu^2 - 1}{r}.$$

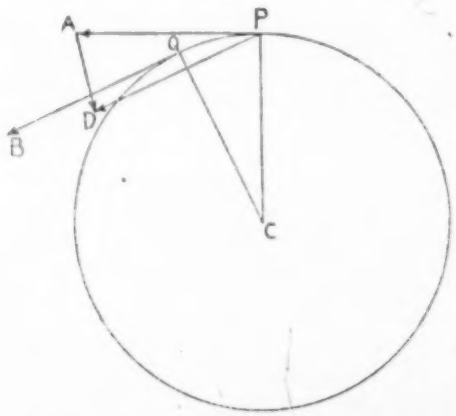
It may form an interesting exercise to prove that if both u and v are measured from the left-hand surface of the lens (the object being to right of lens), then

$$\frac{1}{v} - \frac{\mu^2}{u} = -\frac{\mu^2 - 1}{r}.$$

A.G.—A smooth tube, 15 feet long, turns round a vertical axis at two revolutions per second so as to be always horizontal. A smooth marble is placed in the tube at the vertical axis of rotation. Find (graphically) its velocity when it is swirled out at the other end. (Barker, *Graphical Calculus*, p. 174.)

The first step in this problem is to find the magnitude of the force urging the marble along the tube when at a distance r from the axis of rotation; in other words, to find the centrifugal force acting on a body revolving at a distance r from the centre of revolution with a given velocity v.

Let P (Fig. 1) be the position of the body, whose mass is m, at a given instant, and let PA represent its velocity v in magnitude and direction. PA will, of course, be perpendicular to PC, where C is the centre of revolution. After an



indefinitely short interval of time dt, let the body arrive at the point Q, very near to P. Join QC, and draw QB perpendicular to QC, and equal in length to PA. Then QB will represent the velocity of the body, when at the point Q, both in magnitude and direction. From P draw PD = QB. Then PD also represents the magnitude and direction of the velocity of the body when at the point Q.

Hence, in the time dt (measured in terms of the second as unit), the velocity of the body has been changed from PA to PD. The change of velocity in this time is represented in magnitude and direction by AD. Hence, since the rate of change of velocity per second is equal to the force acting on each gram of the body, we see that the force necessary to constrain the body to move uniformly round the circle is equal to

$$m\frac{AD}{dt}.$$

Now, since Q is supposed to be indefinitely close to P, PA and PD will be very nearly parallel, and AD will be very nearly perpendicular to PA, and will become more and more nearly perpendicular to PA as the arc PQ, and the time dt, are taken smaller and smaller. Hence, in the limit, AD will be perpendicular to PA—that is, it will be parallel to PC. Hence, in order that the body should be constrained to move with uniform velocity round the circle, it must be acted upon with a force, directed toward the centre of revolution, whose magnitude is equal to

$$m\frac{AD}{dt}.$$

To find the value of AD, notice that $\angle$ APD = $\angle$ PCQ. Hence, since the triangles APD and PCQ are both isosceles, they are similar the one to the other. Further, the base of the triangle PCQ will become more and more nearly equal to the arc PQ as the time dt is taken smaller and smaller.

Since the body describes a distance v along the circumference of the circle in one second, in an interval of time dt it will describe a distance vdt. Hence PQ = vdt.

By the similarity of the triangles APD and PCQ, we have

$$\frac{AD}{PA} = \frac{PQ}{PC}.$$

$$\therefore \frac{AD}{v} = \frac{vdt}{r}.$$

$$\therefore \frac{AD}{dt} = \frac{v^2}{r}.$$

Hence the force, directed toward the centre of revolution, required to constrain a body to move round a circle of radius r, with a uniform velocity v, is equal to

$$\frac{mv^2}{r}.$$

Let the body revolve at the rate of n revolutions per second; then $v = 2\pi r \times n = \omega r$, if $\omega = 2\pi n$ = angular velocity of body. Hence

$$\frac{mv^2}{r} = \frac{m\omega^2 r^2}{r} = mr\omega^2.$$

In the case of the smooth marble in the tube, at an instant when its distance from the axis of revolution is equal to r, it would require a force equal to $mr\omega^2$ to keep it from moving farther from the centre. Hence, in the absence of such a force, we may say that at the instant under consideration the marble will be urged from the centre with a force equal to $mr\omega^2$.

To determine the motion of the marble along the tube, we have

$$m\frac{d^2r}{dt^2} = mr\omega^2.$$

Divide through by m, and multiply both sides by $2\frac{dr}{dt}$, which is equal to twice the radial velocity of the marble.

$$2\frac{dr}{dt} \cdot \frac{d^2r}{dt^2} = 2\omega^2 r\frac{dr}{dt}.$$

$$\therefore \int 2\frac{dr}{dt} \cdot \frac{d^2r}{dt^2} \cdot dt = 2\omega^2 \int r\frac{dr}{dt}dt + C.$$

$$\therefore \left(\frac{dr}{dt}\right)^2 = \omega^2 r^2 + C.$$

When $r = 0$, $\frac{dr}{dt} = 0$. $\therefore C = 0$.

Radial velocity of body $= \frac{dr}{dt} = \omega r$.

The same problem can be solved graphically as follows:—

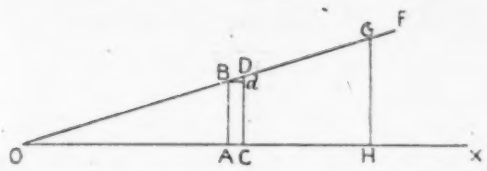
Let the distance of the body from the axis of revolution at any instant be represented by a distance OA, measured along OX (Fig. 2). Then, if AB represent the magnitude of the radial force urging the body along the tube, when at a distance r = OA from the axis of revolution, we have

$$\frac{AB}{OA} = \frac{m\omega^2 r}{r} = m\omega^2 = \text{a constant.}$$

Hence the straight line OBF will represent the radial force acting upon the marble at various points in the tube.

During the time that the marble moves from the point represented by A to that represented by the neighbouring point C (Fig. 2), an amount of work equal to

force exerted × distance traversed = AB × AC



will be performed. But AB × AC = area of rectangle BAC*d*, where B*d* is drawn through B parallel to AC. As AC is taken smaller and smaller, the area of this rectangle will approximate more and more closely to that of the quadrilateral BACD. Since the triangle OGH can be divided into a number of elements similar to BACD, it follows that whilst the marble moves from rest at the point represented by O, to the point H, the total work performed by the radial force will be equal to the sum of these elements, or to the area OGH.

If OH = r = length of tube, work performed by radial force whilst marble moves throughout the length of the tube

$$= \tfrac{1}{2} \times \text{OH} \times \text{HG} = \tfrac{1}{2} \times r \times m\omega^2 r = \frac{m\omega^2 r^2}{2}.$$

This work has been used up in communicating a *radial* velocity (say v) to the body. The consequent amount of kinetic energy generated will be equal to the work performed.

$$\therefore \tfrac{1}{2}mv^2 = \frac{m\omega^2 r^2}{2}.$$

$$\therefore v^2 = \omega^2 r^2,$$

$$v = \omega r.$$

In the problem given, $\omega = 2\pi \times 2 = 4\pi$,

$r = 15$ feet.

$\therefore$ radial velocity of marble on leaving tube $= 60\pi$ feet per second. It should be noticed, however, that this does not represent the resultant velocity of the body. This latter comprises the *radial component* ωr, together with *the component* ωr *at right angles to the tube.* Hence the resultant velocity $= \sqrt{\omega^2 r^2 + \omega^2 r^2} = \omega r\sqrt{2}$.

Nepos.—A man walking along a straight road observes that the greatest angle which two objects subtend at his eye is α. From the place where this happens he walks a yards, and the objects then appear in a straight line, making an angle β with the road. Prove that the distance between the two objects is

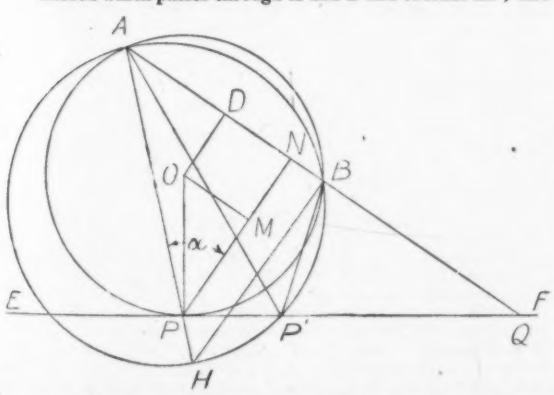
$$\frac{2a \sin \alpha \sin \beta}{\cos \alpha + \cos \beta}.$$

(Lock's *Trig.*, Ex. 72, No. 18.)

Let A and B be the two objects, and EF the road.

If P be the point on the road where the angle APB has a maximum value α, then the circle through A, B, and P will *touch* EF at P.

For, let that circle (centre O and radius r, say) be described which passes through A and B and touches EF; also



any other circle through A and B, and cutting EF at a point P^1.

Then, producing AP to cut the larger circle at H, we see that the angle APB > AHB.

$\therefore$ APB > AP^{1}B.

Now angle AOB = 2α.

Hence AB = 2DB = 2r sin α.

We have therefore to prove that $r = \dfrac{a \sin \beta}{\cos \alpha + \cos \beta}$,

or that $r \cos \alpha + r \cos \beta = a \sin \beta$, or that OD + $r \cos \beta$ = PN, where OD and PN are perpendicular to AQ.

But, from the figure, OD + PM = PN, and also PM = $r \cos \beta$, for clearly OPM = β, since OP and PM are perpendicular to PQ and AQ respectively.

It should now be easy to retrace these steps and establish the required expression for AB.

E. Kitchener.—You cannot sit at the Certificate Examination next July.

Butterpots No. 1.—(*a*) Show that the square root of the decimal value of the infinite series

$$1 + 2 + \frac{4}{1 \times 2} + \frac{8}{1 \times 2 \times 3} + \frac{16}{1 \times 2 \times 3 \times 4} + \ldots$$

is equal to the decimal value of the infinite series

$$1 + 1 + \frac{1}{1 \times 2} + \frac{1}{1 \times 2 \times 3} + \frac{1}{1 \times 2 \times 3 \times 4} + \ldots$$

(Equality should be proved to three or four decimal places.)

(Associateship C.H.E., Newfoundland, 1900.)

(*b*) $x + y = cxy$, $y + z = ayz$, $z + x = bzx$.

(Associateship C.H.E., Newfoundland, 1899.)

(*a*) If this sum is meant to be a mere exercise in computation, we think that no help is necessary. You have merely to take a sufficient number of terms in each series and express them as decimals, then add up, and see if the second is equal to the square root of the first.

Working to seven decimal places, we find the sum of the first to be 7·3890463, and its square root 2·718 . . .; while the sum of the second is 2·7182 . . .

(*b*) Divide the first by xy, the second by yz, the third by xz, and we obtain

$$\frac{1}{y} + \frac{1}{x} = c; \quad \frac{1}{z} + \frac{1}{y} = a; \quad \frac{1}{x} + \frac{1}{z} = b.$$

Subtract the last of these from the first, and *add* the result to the second, thus—

$$\frac{1}{y} - \frac{1}{z} = c - b, \quad \frac{1}{y} + \frac{1}{z} = a.$$

$$\therefore \frac{2}{y} = a + c - b. \quad \therefore y = \frac{2}{a + c - b}.$$

Similarly, $x = \dfrac{2}{b + c - a}$, $z = \dfrac{2}{a + b - c}$.

C. Nicholson, J. H. Boardman, "Royal Irish," Bene, Redder, may have solutions by post.

OUR L.L.A. CORNER.

IN order to more effectually cater for the wants of our lady subscribers, we have determined to set apart space for the consideration and elucidation of difficulties and obscurities that may be encountered by L.L.A. students in the course of their preparation. Obviously we cannot deal exhaustively with every branch of the comprehensive L.L.A. syllabus; but we can (and this is our intention) point out what is important, and what may be omitted, and also call attention to any peculiarities in the questions set. We shall, of course, fulfil our promise in respect to a complete course in Honours English; but this corner will be devoted to difficulties in general, and we are not without hope that it will be one of the most popular and useful features of future issues. This, however, will be for our readers to decide; and if they draw the attention of their student friends to our new departure, and so get them to take advantage thereof, the new feature will permanently remain. If, on the contrary, we find that our help in this connection is not greatly in demand, we shall naturally, in the interests of THE PRACTICAL TEACHER, replace it by something more useful and popular, as it is our wish that every page, nay, every line, of our journal shall bring pleasure and profit to our readers. All applications must be accompanied by the coupon cut from this issue.—ED.

OUR SCIENCE SECTION

☛ **Subscribers requiring Explanations of Difficulties in any branch of Science, or Advice upon Courses of Study, can obtain all help required by communicating with the Editor, and accompanying their query with the Coupon cut from this Number.**

CHEMISTRY NOTES.

BY THOMAS CARTWRIGHT, B.A., B.SC. (LOND.),
First Class Honoursman in Chemistry.

Chlorine Heptoxide.—Messrs. Michael and Conn give an account in *The American Journal of Science* of the preparation of Cl_2O_7, by the action of P_2O_5 on $HClO_4$. In a small glass-stoppered retort, connected with a drying tube filled with P_2O_5, and placed in a freezing mixture of ice and salt, ten grams of P_2O_5 are brought, and, by means of a long tube which is bent inwards and contracted at the delivery end, and has a rubber ball attached to the other end, not more than ten drops of perchloric acid are added, waiting ten minutes before adding a second portion. It is advisable to let the acid drop on the sides of the retort, and the temperature of the freezing mixture should be kept below – 10° C. The retort, left in the freezing mixture, is allowed to stand for a day, then connected with a well-cooled receiver, and slowly warmed in a water-bath to 85° C., when the new oxide passes over. The product obtained in this way is practically pure, and may be used for the experiments described below; but the freshly-prepared substance may be redistilled under ordinary pressure without danger, when it passes over at 82° C. It should be well borne in mind that, even though the above directions for preparing the crude oxide are followed, the apparatus may be virtually pulverised by a violent explosion, and that the personal precautions necessary for work of this kind must be always observed.

Properties of Cl_2O_7.—Chlorine heptoxide is a colourless, very volatile oil that, on standing a day, begins to turn yellow, and after two or three days is greenish yellow, with the liberation of a greenish gas. In comparison with the previously known oxides of chlorine it shows a remarkable stability, and, although when brought in contact with a flame, or by a sharp percussion, it explodes with great violence, it may be poured on paper, wood, or similar organic matter with impunity, the oxide simply volatilising in the air. Brought into a well-cooled tube with some stick sulphur, and the tube corked, no reaction occurred even after standing for several days; and what is a more striking evidence of its stability, it may be poured on a cool piece of phosphorus, and remain for some days without being attached. With cold water it sinks to the bottom of the vessel and passes slowly into perchloric acid, but in a closed vessel it requires some days' standing before the peculiar odour of the oxide has disappeared. Dry and cooled benzene dissolves the oxide, and after a short time a reaction ensues. With iodine a reaction occurs slowly in the dark, more rapidly in the light, with liberation of chlorine and formation of a white solid. The latter substance begins to decompose at 380° C., forming iodine and oxygen, and apparently represents the heptoxide of iodine. Bromine under similar conditions is without action.

Arsenic in Beer.—The detection of arsenic in beer has occupied the attention of analysts throughout the country, and especially in the Manchester district, very considerably during the last two months, and, as a result, the reliability of the various tests for the discovery of minute traces of arsenic has been severely tested. To the surprise of most people, the well-known Marsh's test has not proved worthy of trust, especially in the presence of acid sulphites with which cheap beer is frequently adulterated. Mr. Estcourt, the Manchester analyst, failed to detect arsenic in several samples of arsenical beer by reason of the presence of the bisulphites of calcium and magnesium, the reason being that the zinc and acid produced nascent hydrogen, which combined with the sulphur of the sulphite, whereby sulphuretted hydrogen was generated, which tends to prevent rather than to promote the formation of arsine, since the sulphuretted hydrogen reacts with the arsenic compound to form arsenic sulphide. The remedy is to boil the beer for some time with acid before adding the metal, or, better still, to boil with a little bromine water. Reinsch's copper test appears to have come out of the ordeal most successfully, concerning which the following remarks by Mr. Alfred H. Allen are of interest: "I have recently had a considerable number of samples of beer to examine for arsenic, and find Reinsch's test to be the most satisfactory. I purify the hydrochloric acid employed by distilling off about one tenth: this fraction contains the minute traces of arsenic originally present. I operate, as a rule, on 100 c.c. of the beer, and, as a preliminary treatment to eliminate sulphites, add hydrochloric acid and a little bromine water, and boil the liquid for a few minutes. To obviate the difficulty caused by the fact that arsenic acid only responds to Reinsch's test after prolonged boiling, and in presence of much acid, a little solution of cuprous chloride in hydrochloric acid is next added, which reduces the arsenic to the arsenious condition. On now introducing about 1 c.c. of copper foil, and boiling, any arsenic is promptly deposited on the copper. If the copper has undergone darkening, it is dried in the water oven, cut into strips, and heated in a narrow tube, when the characteristic crystals of arsenious oxide are deposited in the form of minute octahedra or tetrahedra."

For a speedy qualitative determination the following procedure is recommended by Mr. H. S. Madan:—"Place in a test-tube about 6 or 8 c.c. of the liquid to be treated, add about a gram of solid caustic potash, and heat the mixture nearly to boiling. Drop into the solution a bit of aluminium foil, and lay on the mouth of the test-tube a small piece of filter-paper moistened with solution of silver nitrate. If arsenic is present, hydrogen arsenide will be evolved, and will decompose the silver nitrate, which will turn black owing to the formation of metallic silver.

"The presence of compounds of sulphur or of phosphorus does not interfere with the above test, since they are retained by the strongly alkaline solution, and no hydrogen sulphide or phosphide is formed."

New Method of Determining Arsenic.—M. Ducru in *Comptes Rendus* says:—"In a weak ammoniacal solution rich in ammonia salts, arsenic acid can be completely precipitated by cobalt salts. This reaction can be employed in estimating arsenic. The conditions necessary are very simple: the cobalt must be in decided excess, about one and a half times the theoretical quantity, and the solution should be slightly ammoniacal. If it contains in the free state 1·5 per cent. of its volume of 20 per cent. solution of ammonia, the conditions for the formation of monoammonic arsenate of cobalt are fulfilled. Practically, to allow for loss during heating, about 3 per cent. should be taken. It is also necessary to charge the liquid with ammonium chlorohydrate, about 100 grams per litre, though in certain cases it is preferable to use acetate."

Qualitative Separation of Sb and Sn.—In the *Zeitschrift für Angewandte Chemie*, Herr Borneman gives the following interesting separation of these two members of Group II. (*b*):—"When we add a quantity of soda-lye to a solution of chloride of antimony, until the precipitate formed is redissolved, and then treat the solution with a sufficient quantity of phosphate of sodium and boil, there is no precipitate formed as long as the liquid is warm. A solution of stannic chloride subjected to the same treatment loses nearly the whole of its tin in the form of a dense white precipitate. But on treating a mixture of chloride of antimony and chloride of tin in the same manner, the precipitate of stannic phosphate always carries down a certain amount of antimony. However, the filtrate is free from tin, and sulphuretted hydrogen only causes an orange precipitate or cloudiness of sulphide of antimony. These facts have enabled me to devise the following process:—The liquid to be examined should contain all its tin in the form of stannic chloride. We

then add a drop of phenol phthalein or litmus and enough soda to obtain a clear solution with a strongly alkaline reaction. The solution thus obtained is treated with a sufficient excess of a solution of phosphate of sodium, and the whole made slightly acid with nitric acid. It is then boiled and left to stand for some time. If no precipitate forms, it is diluted and heated over again. The continued absence of a precipitate shows the absence of tin. The phosphate of tin is thrown on a filter, and the filtrate treated with sulphuretted hydrogen."

Ammonium Bromide and the Atomic Weight of Nitrogen.—During a research having for its chief aim the detection of the oxygen to hydrogen ratio by comparing the equivalents of hydrazine ammonia and hydroxylamine, the author (Mr. A. Scott) found that he could not obtain the same equivalent as Stas for ammonium bromide. The value given by Stas is 98·032, whilst that of the author is 97·996, his highest value being 98·003. This would lower the atomic weight of nitrogen from 14·046 to 14·010, a number much nearer to that deduced from the relative densities of oxygen and nitrogen (16 : 14·003).

The equivalent for ammonium chloride was also determined, and found to be 53·516, as against 53·532 (Stas) and 53·486 (Marignac).

The silver used was prepared by the reduction of silver nitrate by means of ammonium formate, and was notably better than a sample prepared with the utmost care by the well-known cuprous ammonium sulphite process. To test the purity of the silver in the severest way, the precipitated silver bromide was reduced by hydrogen, when identical results were obtained with the silver so prepared.

NOTES ON ADVANCED AND HONOURS PHYSIOGRAPHY.

Oxygen in Stars. (By request.)—In a paper contributed to the Royal Society on April 4, 1897, attention was drawn to the special lines in the spectra of the first division of helium stars, which lines were supposed to be due to oxygen. These stars are associated by position and distribution with gaseous nebulæ, and some of the lines in their spectra correspond with the bright lines obtained by Campbell from nebulæ. The suggestion from this was that these stars are in the first stage of stellar development from gaseous nebulæ.

The special lines referred to are the extra lines which distinguish these spectra from the remaining helium stars of division D.

The indications in the spectrum of **Northern** stars that these extra lines are due to oxygen are slight, and, at the best, but indistinct. Among **Southern** stars there are several in the spectra of which these extra lines are better defined, and there is one—namely, β Crucis—in which they are very fairly defined. Taken in the order named, α Orionis, β Scorpionis, β Canis Majoris, β Centauri, and β Crucis exhibit these supposed oxygen lines in increasing distinctness, pointing to identity of origin throughout the series.

The extra lines in the spectrum of β Crucis are singled out by comparison with ϵ Argos of Division I. (*b*), in which the extra lines do not appear. The lines are drawn out by themselves below the spectrum of β Crucis: a diagram is given with the original memoir, for which see *Proceedings of the Royal Society* (vol. lxvii., p. 417). They are then compared directly by juxtaposition with a drawing of the spectrum of oxygen as tabulated in the spectrum of air by Neovius. This comparison shows a close correspondence in the grouping of the extra lines with the spectrum of oxygen. The most remarkable correspondence is in the case of the large group on either side of H δ. A slight shift of about a metre is required to bring the groups into identical positions. However, the close similarity of the whole grouping of the two spectra as they appear on the plate admits of little doubt but that the extra lines constitute the spectrum of oxygen. If this is admitted, then the spectrum of the first class of helium stars would be due to hydrogen, helium, and oxygen.

Criticism by Sir Norman Lockyer.—With respect to the statement that certain of the oxygen lines (amongst which is the strong triplet λλ 4070·1, 4072·4, and 4076·3) appear in the spectrum of β Crucis and other stars of nearly equal temperature, our observations (that is, those of Sir Norman and his son, Dr. Lockyer) tend to confirm this view; but other photographs and more laboratory work are needed to explain certain changes of intensity which have been observed. The lines attributed to oxygen have been noted between α Crucis and ζ Orionis in the upward series, and in stars at about the α Eridani stage of temperature in the downward series.

The Planet Eros. (By request.)—It was on August 13, 1898, that Herr Witt, of the Urania Observatory, discovered, by means of its photographic impression, the tiny wanderer which at first was known by the letters DQ, and finally as the planet Eros.

The Planet's Elements.—These were promptly determined by Herr Berberich of Berlin, from observations made by the discoverer. The deduced elements are as follows:—

Mean distance from the sun	1·4606
Least distance from the sun	1·.266
Greatest distance from the sun	1·7946
Eccentricity	0·22865.
Inclination to ecliptic	11° 6′ 57″.
Longitude of ascending node	303° 48′ 53″.
Longitude of perihelion	122° 17′ 14″.
Aphelion passage (June 1898)	20d.·443
Average daily motion	2010″·131.
Period = 664·734 dys. = 1 y. 9 m. 6 d.	

The earth's mean distance from the sun.

Berlin mean time.

Distance from the Earth.—The fact that aroused most interest in Witt's discovery is that the new planet comes nearer to our earth than any other of the heavenly bodies, the moon alone excepted. In the following table are shown the **least distances** of the Moon, Eros, Venus, and Mars from the Earth, both in astronomical units and in miles.

Body.	Distance from the Earth.	
	(1) In Astronomical Units.	(2) In Miles.
Moon	0·0026	235,000
Eros	0·143	13,300,000
Venus (in transit)	0·264	24,500,000
Mars (in perihelion)	0·372	34,600,000

Dimensions of Eros.—The brightness of Eros is at present about the same as that of a star of the eleventh magnitude, from which, knowing its distance from the sun and the earth at the same time, it is deduced that the diameter is from 17 to 25 miles. Hence when nearest to us its disc will subtend an angle of about $\frac{1}{2}''$, a quantity too small for even the most powerful telescopes to measure; hence Eros will shine as a point of light; and as, when nearest to the earth, it will shine as brightly as a star between the sixth and seventh magnitudes, observers gifted with acute vision may just be able to make it out as a speck of light with the unaided eye. At its nearest approach the new planet will be in Cancer, and therefore will be well situated for northern observers. Assuming that the density of Eros is the same as that of the moon, its mass will be only the two-millionth part of that of the moon, a quantity quite negligible in astronomical calculations.

A Favourable Opposition.—When the planet is in perihelion, and the earth is in the longitude of the planet's perihelion (that is, 123° 17′), the most favourable opposition for observation will occur. From *The Nautical Almanac* we learn that it passes this longitude on January 22 each year. We have therefore to determine a year when the planet makes its perihelion passage at this date. We find, to our regret, that Eros passed its perihelion on January 21, 1894, and that such a favourable state of affairs will not again present itself until 1924, when the perihelion will be passed on January 25. In November of this year the earth again overtook the planet, which was then distant about 31,000,000 miles—a distance more than double, it is true, than that obtaining in 1894, but still much less than the distance of Mars, even when nearest; hence there has recently been a universal turning of telescopes to Eros, with what results remains yet to be seen.

Eros and the Sun's Distance.—The value of such a near approach to the earth as that presented by Eros lies in the fact that we may utilise it for obtaining a more accurate knowledge of that most important astronomical unit—namely, the sun's distance from the earth. For this purpose Eros is admirably adapted, both from its smallness and from its proximity. The method adopted consists in the heliometric measurement of the distances of the planets from a number of neighbouring stars, the measurements being made with the planet alternately east and west of the meridian, the observer having in the interval been carried by the earth's diurnal motion through several thousands of miles, whereby the planet appears now on one and again on the other side of the place it would have been seen from the centre of the earth. This aberration enables us to calculate the distance of the planet from the earth, and by Kepler's law we may easily deduce the distance of the sun.

The most recent and probably the most accurate determination of the sun's distance is that of Dr. Gill, who gives it as 92,874,000 miles. This was got from heliometric determinations of Iris, Victoria, and Sappho, whose least distances are, in astronomical

units, respectively 0·84, 0·82, and 0·84. Now, as the least distance of Eros is 0·14, or one-sixth of these, by using Eros in place of the asteroids employed by Dr. Gill, the possible error of observation will be reduced by one-sixth.

Eros and its Perturbations.—Coming so close to the earth as Eros does, and being so small, it is evident that the tiny planet will be greatly perturbed by the attraction of the earth; and as the measure of these perturbations will be the measure of the earth's mass, a careful determination of the variation in perturbation corresponding to the variable distances that the planet will be situated from us will enable astronomers to calculate the mass of the earth as compared with the mass of the sun, and hence the distance of the latter. This, however, will require a long series of observations, spread over many years, before any reliable results can be obtained.

When did Eros appear?—Some astronomers are inclined to the opinion that Eros has only just, by the disturbing powers of the larger planets, been attracted into its present orbit. This is highly improbable, for at the minimum distance of 0·14 the earth would be powerless to change the planet's orbit, except slowly; and the great disturber of the orbits of the smaller planets, the giant Jupiter, never comes nearer than 3·2 astronomical units to Eros, and would consequently have little perturbing effect. We must therefore admit that the planet has probably been under our noses, so to speak, for ages, and only our lack of discrimination has prevented us from recognising its presence.

ELECTRICITY AND MAGNETISM.

NOTES ON ADVANCED AND HONOURS STAGE.

BY EDWIN EDSER, A.R.C.S., F.PH.S.

HAVING now briefly reviewed the most important cases in which work is done by an electric current, we are in a position to draw an important distinction between the terms "difference of potential" (P.D.) and "electro-motive force" (E.M.F.). In any case where work is done by the electric current there will be a corresponding difference of potential, determined from the relation

$$\text{P.D.} = \frac{\text{work performed per second}}{\text{current}}.$$

It will have been noticed, however, that in one case, where the work performed is equivalent to the heat produced between two given points on a uniform conductor, the P.D. depends on the value of the current, the relation between these being

$$\text{P.D.} = \text{current} \times \text{resistance} = \text{CR}.$$

It is not correct, therefore, in this case to say that the difference of potential is equal to the work performed per unit quantity of electricity passing between the given points on the conductor, since the P.D. will vary according as this quantity of electricity passes rapidly (when C will have a large value) or slowly (when C will have a small value).

On the other hand, the difference of potential resulting from the performance of chemical work will be independent of the current; its value will depend only on the nature of the chemical reaction involved, and, to a smaller extent, on the temperature at which the reaction takes place, the nature of the electrodes used, the concentration of the solution electrolysed, etc. Hence in this case we may define the resulting P.D. as the work done per unit quantity of electricity.

Similarly, the P.D. at a junction of two metals will be independent of the current passing, which is expressed by saying that the work done per second at that junction is equal to PC, where P is the Peltier coefficient, corresponding to the junction in question when kept at a given temperature. *The term electro-motive force* (E.M.F.) *can be applied to the difference of potential between two points in a circuit, provided that the value of that* P.D. *is independent of the current flowing.* Thus the term thermo-electric force at a junction is justified. We may speak of the E.M.F. necessary to effect a given chemical decomposition; but we must use the term "difference of potential" (P.D.) when referring to different points on a uniform conductor through which an electric current is passing.

Problem.—The E.M.F. of a given cell is 1·5 volts, and its internal resistance is equal to 1 ohm. Draw a curve showing the relation between the terminal P.D. of the cell and the resistance which is included in the external circuit of the same.

By "the terminal P.D." of the cell we mean the difference of potential, which occurs in the external circuit, between the terminals of the cell.

In a cell producing an electric current, we have a liberation of energy due to the occurrence of some definite chemical change. The total amount of energy liberated will, as previously explained in detail, be proportional to the total quantity of electricity produced, and will be independent of the *rate* at which the electricity is generated. Thus the total quantity of work which can be performed by each unit of electricity produced will depend only on the nature of the chemical reactions occurring in the cell, and will be independent of the value of the current. Hence the term "E.M.F. of the cell."

In the above problem, the work done by the electric current is equivalent to the sum of (*a*) the heat produced inside the cell, owing to the resistance of the liquids, etc., contained in the cell, and (*b*) the heat produced outside the cell, owing to the resistance of the conductors, comprised in the external circuit.

Let E = E.M.F. of cell—that is, energy liberated with each unit quantity of electricity produced.

W_1 = work performed per second in heating liquids, etc., inside cell.

W_2 = work performed per second in heating conductors outside cell.

C = the current flowing during time t.

Then quantity of electricity produced in time $t = Ct$.

Energy liberated by cell in time $t = ECt$.

$\therefore ECt = W_1t + W_2t$ (by the law of conservation of energy).

$$\therefore E = \frac{W_1}{C} + \frac{W_2}{C}.$$

But $\frac{W_1}{C}$ = difference of potential occurring inside cell, by definition of P.D.

$\frac{W_2}{C}$ = difference of potential occurring outside cell.

Hence we see very clearly that the E.M.F. of the cell is equal to the total fall of potential, passing once completely round the circuit, or to the fall of potential inside cell + fall of potential outside cell.

Now, since Ohm's law holds both for solid metallic conductors and also for electrolytes, we have P.D. inside cell $\left(= \frac{W_1}{C}\right)$ when current C is flowing = C × internal resistance of cell = Cr, if r = internal resistance of cell.

Similarly, if R = resistance of external circuit, we have

$$\text{P.D. outside cell} = \frac{W_2}{C} = CR.$$

$$\therefore E = Cr + CR = C(r + R) \quad . \quad . \quad . \quad . \quad (1)$$

Let V = fall of potential outside cell = terminal P.D. of cell.

$$\text{Then } V = CR \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

Dividing (2) by (1), we get

$$\frac{V}{E} = \frac{R}{r + R}.$$

$$\therefore V = E\frac{R}{r + R}.$$

It now becomes obvious that the terminal P.D. of cell will vary with R, the resistance in the external circuit.

1. Let us suppose that R is very great in comparison with r, the internal resistance of the cell. Then

$$V = E\frac{R}{r + R} = E\frac{1}{\frac{r}{R} + 1} = 1,$$

if we neglect the value of $\frac{r}{R}$, which will be very small in comparison with 1.

Hence, when the resistance of the external circuit is very great in comparison with the internal resistance of the cell, the terminal P.D. will be equal to the electro-motive force of the cell.

It should be noticed that in this case practically the whole of the work done by the cell is utilised in heating the external circuit. This follows from the fact that C^2Rt will be very great in comparison with C^2rt.

2. Let us suppose that the terminals of the cell are joined by a wire of negligible resistance. Then we may write R = 0.

$$V = E\frac{0}{r + 0} = 0.$$

Hence in this case the whole fall of potential occurs inside the cell itself. Practically the whole of the work done is utilised in heating the liquids, etc., in the cell. This follows from the fact that C^2rt will be very great in comparison with C^2Rt.

In the problem given,

E = 1·5 volts,

r = 1 ohm.

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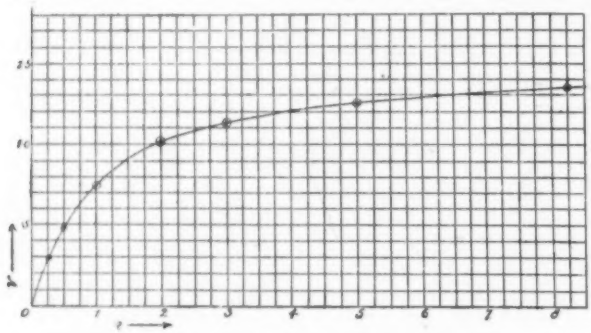
The accompanying diagram is obtained by substituting the values ·25, ·5, 1, 2, 3, 5, and 8 for R, in the equation

$$V = 1{\cdot}5\,\frac{R}{R+1},$$

and plotting the various values of V vertically above the corresponding values of R, and finally joining the points so obtained by a continuous curve. It becomes obvious that V at first



increases rapidly with R; and then increases more slowly, approaching the value V = 1·5 as R is increased indefinitely.

Notice that when R = 1, and the resistance of the external circuit is equal to the internal resistance of the cell, the terminal difference of potential = ·75 volt = $\frac{1{\cdot}5}{2}$ volts. In other words, when the resistance of the external circuit is equal to the internal resistance of the cell, then the fall of potential inside the cell is equal to the fall of potential in the external circuit, either being equal to half the E.M.F. of the cell.

Voltmeters.—A voltmeter is an instrument designed to indicate the difference of potential between any two points of a circuit to which the terminals of the voltmeter are connected. Be careful not to confuse this instrument with a *voltameter*, which is an arrangement for determining the total quantity of electricity which has passed along a circuit in a given time, by causing that electricity to electrolytically deposit a metal (generally silver or copper) on an electrode which is weighed before and after such deposition. Voltmeters may be divided into two classes:—

1. *Electrostatic Voltmeters.*—In these instruments a movable vane, which is generally kept charged to a constant potential, is differentially attracted by fixed discs, which are connected to the terminals of the instrument, so that their difference of potential is equal to that of the two points in the circuit to which the terminals are connected. In these instruments there is no flow of electricity. The best known of such instruments is Lord Kelvin's quadrant electrometer.

2. *Ordinary Voltmeters.*—A galvanometer which possesses a very high resistance, and whose deflections are proportional to the current flowing through it, can be used as a voltmeter.

For let unit deflection of the voltmeter correspond to a current of k ampères.

Then a deflection of θ divisions will correspond to $k\theta$ ampères.

Let E be the (unknown) E.M.F. of a cell, of which the internal resistance is equal to r ohms.

Let R ohms be the resistance of the galvanometer.

Then if the terminals of the galvanometer are connected to the terminals of the cell, the current flowing through the galvanometer will be equal to

$$\frac{E}{r+R}.$$

If the deflection of the galvanometer is θ divisions, we have

$$k\theta = \frac{E}{r+R}.$$

$$\therefore\ E = k(r+R)\theta.$$

Now, if R is very great (say 60,000 ohms), the value of r will generally be so small that $r + R$ will only be about ·01 per cent. greater than R. Hence, if we do not require an accuracy greater than ·01 per cent., we may write

$$E = kR\theta.$$

Since both k and R have constant values, E will be proportional to θ, the deflection of the voltmeter; and the value of kR having once been determined, E will become known from the deflection θ of the instrument.

Similarly, if the terminals of a voltmeter of this description are connected to any two points in a circuit, the deflection of the voltmeter will be proportional to the difference of potential between the two points.

Problem.—The terminals of a cell are connected by means of a wire of resistance = 2 ohms, and it is found that the terminal P.D. of the cell is equal to ·8 volt. When the terminals of the cell are joined by means of a wire of resistance = 1 ohm, the terminal P.D. of the cell falls to ·5 volt. What is the E.M.F. and internal resistance of the cell?

As proved above, V, the terminal P.D. of a cell of E.M.F. = E, is given by

$$V = E\,\frac{R}{R+r}.$$

From the above, $\quad \cdot 8 = E\,\frac{2}{2+r} \quad \ldots\ldots\ (a).$

$$\cdot 5 = E\,\frac{1}{1+r} \quad \ldots\ldots\ (b).$$

Dividing (a) by (b), we get

$$\frac{2}{2+r}\cdot\frac{1+r}{1} = \frac{8}{5}. \quad \therefore\ \frac{1+r}{2+r} = \frac{4}{5}.$$

$$5(1+r) = 4(2+r),$$

$$r(5-4) = 8-5 = 3.$$

$\therefore\ r = 3$ ohms = internal resistance required.

Substituting this value of r in (b), we get

$$\cdot 5 = \frac{E}{1+3} = \frac{E}{4}. \quad \therefore\ E = 2 = \text{required E.M.F.}$$

MATHEMATICS.

STAGES 2 AND 3, BOARD OF EDUCATION, SOUTH KENSINGTON.

Stage 2.

Algebra.

Surds.—Hall and Knight, chap. xxxi.; C. Smith, chap. xx.; Todhunter and Loney, chap. xxx.; H. Smith, chap. xxiv.

Attend to the following:—

1. Be able to state the exact meaning of a *surd* or *irrational quantity*.

2. Know when two surds are similar—for example, $3\sqrt{7}$, $5\sqrt{7}$—and that $\sqrt{28}$ can be reduced to a surd similar to each of these, for $\sqrt{28} = \sqrt{4\times 7} = 2\sqrt{7}$.

3. Observe that if we have the *sum* of two surd terms, say $\sqrt{3}+\sqrt{2}$, and we multiply this by the *difference* of these terms (that is, $\sqrt{3}+\sqrt{2}$), the product is *rational*—namely, 3 – 2, or 1 (either of the expressions $\sqrt{3}+\sqrt{2}$, or $\sqrt{3}-\sqrt{2}$, is said to be a rationalising factor of the other).

This result is useful in so far that it provides a source from which an unlimited supply of simple exercises may be obtained.

A student should therefore understand that an examiner often sets questions on surds with the object of testing whether the candidate will observe the presence of rationalising factors, or whether he is ready to introduce such factors in order to simplify a given expression.

4. If we wished to find the value of $\frac{5}{\sqrt{7}-\sqrt{3}}$, we might proceed by finding the values of $\sqrt{7}$ and $\sqrt{3}$ to 3 or 4 decimal places, and then *dividing* their difference into 5. But if we multiply the numerator and denominator by the *rationalising factor* of $\sqrt{7}-\sqrt{3}$ (that is, $\sqrt{7}+\sqrt{3}$), we obtain

$$\frac{5(\sqrt{7}+\sqrt{3})}{7-3} \text{ or } \frac{5(\sqrt{7}+\sqrt{3})}{4},$$

and it is generally considered to be less trouble to add the approximate decimal values of $\sqrt{7}$ and $\sqrt{3}$, and then multiply by $\frac{5}{4}$, than to proceed as at first suggested.

The student is very frequently called upon to employ this artifice of *rationalising the denominator*.

5. Attend to the method explained in the text-books for finding the square root (when possible) of an expression of the form $a+\sqrt{b}$.

Work examples selected from the sets to be found in the text-books; also the following:—

1. Find the value of $(\sqrt{5}+\sqrt{3})^4 + (\sqrt{5}-\sqrt{3})^4$.
(1900, Evening.)
Ans. 248.

2. Reduce $\frac{3}{3-\sqrt{5}} + \frac{2}{3+\sqrt{5}}$ to the form $a+n\sqrt{b}$, and find its value as a decimal, having given $\sqrt{5} = 2{\cdot}2361$.

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Extract the square root of $1\cdot5 + \sqrt{2}$ in a surd form, and verify the result by decimals, having given $\sqrt{2} = 1\cdot4142$.
(1900, Evening.)

Ans. $\frac{15}{4} + \frac{1}{4}\sqrt{5}$, $4\cdot309$; $1 + \frac{\sqrt{2}}{2}$.

3. If $a + \sqrt{b} = x + \sqrt{y}$, where a and x are rational and $\sqrt{b}$ and $\sqrt{y}$ are irrational, show that $a = x$ and $b = y$.
What do the words "rational" and "irrational" mean in the statement?

Reduce $\left(\frac{3 + \sqrt{5}}{2 + \sqrt{5}}\right)^2$ to a form in which the denominator is unity, and find its value as a decimal, having given $\sqrt{5} = 2\cdot2361$.
(1899, Day.)
Ans. $6 - 2\sqrt{5}$.

4. Reduce to its simplest form—

$$\frac{1 - \sqrt{2} + \sqrt{3}}{1 + \sqrt{2} + \sqrt{3}} \cdot \frac{1 - \sqrt{2} - \sqrt{3}}{1 + \sqrt{2} - \sqrt{3}}.$$

Find in its simplest surd form the value of $a^3 - 8a^2$, when $2a = 3 - \sqrt{7}$; and find its value as a decimal, having given $\sqrt{7} = 2\cdot64575$.
(1899, Evening.)

Ans. $2\sqrt{3}$; $\frac{\sqrt{7} - 3}{8}$, $-\cdot04428$.

Trigonometry.

In the September and October numbers we pointed out the necessity for each reader of these notes to possess a book of mathematical tables. We should be sorry to find that there are any students without such a book, because they are sure to obtain misleading ideas. Many of the exercises which we give cannot be worked without such tables. After a little practice in using the tables, exercises on right-angled triangles (or any kind of triangle), and such exercises as "find the four, six, eight, etc., least values of θ which satisfy such equations as $1\cdot6 \sin\theta = \cdot7$, $2\cos^2 2\theta = 1\cdot8$, $25 \tan 3\theta = 18$, etc.," become extremely simple.

In the examination in this section, an extract is made from a book of tables, so as to contain just as many as will suffice for the questions on the examination paper. But if it were not for certain little difficulties, every candidate would be provided with a full set of tables, from which he could use whichever he pleased. On the other hand, for the solution of many problems which occur in practical work, the tables are absolutely necessary.

Hitherto we have not given the rules for calculating by means of logarithms, nor have we attempted to explain the arrangement of the logarithms as they appear in the tables. For examination purposes, a student should be prepared to establish the rules.

Read Hall and Knight, chaps. xiv. and xv.; Loney, chaps. x. and xi.; Lock, chaps. xiv. and xv.; H. Smith, chaps. xiv. and xv.

Work a few examples from each of the sets in the above chapters.

A student must not suppose that it is necessary to be able to work all these exercises before he can use a table of logarithms; many of them are useless for such a purpose.

Geometry.

Read Props. 16 to 22, and work the following:—

1. If two circles can be described so that each touches the other and three of the sides of a quadrilateral figure, then the difference between the sums of the opposite sides is double the common tangent drawn across the quadrilateral.

2. APB is a fixed chord passing through P, a point of intersection of two circles AQP, PBR; and QPR is any other chord of the circles passing through P. Show that AQ and RB, when produced, meet at a constant angle.

Stage 3.

Algebra.

Work the following examples:—

1. Determine k so that $x^2 - (2k - 3)x + 2k = 0$ may have equal roots. Ans. $\frac{1}{2}$, or $\frac{9}{2}$.

2. If the roots of $x^2 - px + q$ be real, and differ by less than f, then q must be between $\frac{1}{4}p^2$ and $\frac{1}{4}(p^2 - f^2)$.

3. If $x^2 + y^2 = 1$, and $x + y = 2$, show that $(x^2 + x + 1)^2 + (y^2 + y + 1)^2 = \frac{5}{2}$.

4. $2y - yz = 4$, $2z - zx = 9$, $2x - xy = 16$. Ans. $-\frac{8}{3}$, $\frac{8}{3}$, $\frac{8}{3}$.

5. If a, b, c be in G.P., and $a + x$, $b + x$, $c + x$ in H.P., then $x = b$.

6. Find five numbers in geometrical progression such that their sum shall be 124, and that the quotient of the sum of the first and last by the middle term shall be $4\frac{1}{4}$.
Ans. 4, 8, 16, 32, 64.

7. Find the conditions that $(x - a)^2$ be a factor in $x^3 + px + q$.
Ans. $p = -3a^2$, $q = 2a^3$.

8. On a railway there are fifteen stations. Find the number of tickets required in order that it may be possible to book a passenger from every station to every other. Ans. 210.

9. How many different integral numbers of three significant digits can be made with the six digits 12304? Ans. 52.

Trigonometry.

Read Loney, Arts. 109–114; also 128–133. Hall and Knight, Arts. 251–257; Art. 317.

Work the following examples:—

1. Prove the identities—

$$\sin 3a + \sin 7a + \sin 10a = 4 \sin 5a \cos\frac{7a}{2} \cos\frac{3a}{2}.$$

$$\cos 3A \sin 2A - \cos 4A \sin A = \cos 2A \sin A.$$

$$\sin^2 5A - \sin^2 2A = \sin 7A \sin 3A.$$

2. If $\tan\theta = \frac{b}{a}$, prove that $a\cos 2\theta + b \sin 2\theta = a$.

Prove that $\sin 4A = \frac{4 \tan A(1 - \tan^2 A)}{(1 + \tan^2 A)^2}$.

3. $\frac{c \sin(A - B)}{b \sin(C - A)} = \frac{a^2 - b^2}{c^2 - a^2}$, where ABC is a triangle.

4. Find θ from the equation $\sin^2\theta = \cos^2 a \cos\beta$, where $a = 32° 47'$, and $\beta = 41° 19'$. Ans. $68° 25' 6''$.

5. If $\sin\beta$ be the geometric mean between $\sin a$ and $\cos a$, prove that $\cos 2\beta = 2\cos^2\left(\frac{\pi}{4} + a\right)$.

6. There is a line, EF, and two points, A and B, on the same side of EF. Take *any* point P on EF; show that the angle APB is greatest when P is the point of contact of one of the circles which pass through AB and touch EF.

A man walking along a straight road observes that the greatest angle which two objects subtend at his eye is a; from the place where this happens he walks a yards, and the objects then appear in a straight line, making an angle β with the road. Prove that the distance between the two objects is

$$\frac{2a \sin a \sin\beta}{\cos a + \cos\beta}.$$

Geometry.

Work the following exercises on Props. 1 to 13, Book VI.:—

1. Show that the radius of a circle is a mean proportional between the segments of any tangent between its point of contact, and a pair of parallel tangents.

2. Two circles intersect at A and B, and at A tangents are drawn, one to each circle, to meet the circumferences at C and D. Show that if CB, BD are joined, BD is a third proportional to CB, BA.

3. The diameter AB of a semicircle is divided at any point C, and CD is drawn at right angles to AB, meeting the circumference in D. DO is drawn to the centre, and CE is perpendicular to OD. Show that DE is a third proportional to AD and DC.

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When the point of application moves in the direction of the force, then the work done is P × S, where P denotes the force

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and S the displacement. The two special cases referred to are included in the formula PS cos θ . . . (i.), where θ is the angle between the direction or line of action of the force and the direction of motion. When $\theta = 0°$, then cos $\theta = 1$, and equation (i.) becomes PS. If the angle be 60°, then as cos $60° = \frac{1}{2}$, from (i.) work done = $\frac{1}{2}$PS.

Ex. 1. Let P = 120 lbs. weight, S = 100 ft., and $\theta = 60°$.

Then work done = $120 \times 100 \cos 60° = 6000$ ft.-lbs.

When the point of application moves at right angles to the direction of the force, ∴ when $\theta = 90°$, as cos 90° = 0, no work is done. This is doubtless sufficiently obvious, as is also the statement that no work is done by the weight of a body which moves in a horizontal direction.

The work done by a *variable* force is frequently required. A familiar example is furnished by the expansion or compression, according to Boyle's Law, of a given quantity of gas—that is, when *the force exerted varies inversely as the volume, the temperature remaining constant.* In applying the law, the conditions that it holds for a *given quantity*, and that the *temperature remains constant*, should be carefully noted. This latter condition really means that heat must be abstracted from the gas when compressed, and added to it when expanded. Also, in the case of the more permanent gases (oxygen, air, etc.), departures from the law, even under a pressure of several atmospheres, can only be ascertained by very accurate experiments; but with less permanent gases, such as carbonic acid, etc., as they approach liquefaction the departures from the law may be considerable. Using the ordinary symbols P and V to denote pressure and volume, then $P \propto \frac{1}{V}$, or $PV = k$, where k is a constant.

From two simultaneous values of P and V the value of the constant k can be obtained.

Then, given the value of P or V at any other point, the remaining term P or V can be ascertained by dividing by the known value. In this manner, given, say, a series of values for V, corresponding values of P can be obtained. These may be represented by a curve, in which the ordinates represent the varying values of the pressure, and the abscissæ the volumes; the area of the curve, and therefore the work done, can be found by any of the well-known rules in mensuration. When the curve is the Boyle's Law or hyperbolic curve, the area of the curve may be readily obtained by using the formula $PV \log_e r$, where r denotes the ratio of the final to the initial volume of the gas.

In the January issue of THE PRACTICAL TEACHER an example, fully worked out, is shown in which P, V, and r are known quantities, but any one of the terms in the equation may be the unknown quantity, and may be obtained when the remaining terms are known. A case in which the final volume is required is shown in the following example.

Ex. 2. A given quantity of air is allowed to expand without change of temperature. At first its volume is 10 cubic feet, and the pressure is that of 16 atmospheres. Find its final volume, if 835,200 foot-pounds of work have been done in the expansion. (*N.B.*—1 atmosphere = 14·5 lbs. per square inch, $\log_e 12 = 2{\cdot}485$, $\log_e 13 = 2{\cdot}565$.) (1900.)

Here, instead of pressure and initial and final volumes to find work done, we are given initial pressure, volume, and work done to find the final volume. Hence, if V denote initial volume, and V_1 final volume, then $PV \log_e \frac{V_1}{V}$ = work done = 835,200 ft.-lbs.

$$\therefore 16 \times 14{\cdot}5 \times 144 \times 10 \log_e \frac{V_1}{10} = 835{,}200.$$

$$\text{Hence } \log_e \frac{V_1}{10} = \frac{835200}{16 \times 14{\cdot}5 \times 144 \times 10} = 2{\cdot}5,$$

$\log_e 13 = 2{\cdot}565$, and $\log_e 12 = 2{\cdot}485$.

$\therefore$ difference = ·080.

Also, 2·5 − 2·485 = ·015.

Hence the final volume is 12·5 cubic feet (nearly).

In the general case, when the extremities of the ordinates indicating the varying magnitudes of a variable force are joined by a curve, the area of such a curve may be obtained most accurately by Simpson's Rule.

To apply the rule, the base is divided into an even number of spaces. This gives an odd number of ordinates, 3, 5, 7, etc. The rule gives that the area is obtained by *adding the end ordinates, four times the sum of all the even ordinates, and twice the sum of all the odd ordinates; finally multiply the result by one-third the common interval between two consecutive ordinates.* It will be noticed that when the numerical values of equidistant ordinates are given, it is not necessary to draw the curve.

Ex. 3. Draw a line Ax, and take in it five equidistant points B, C, D, E, F. Suppose a force P to act along Ax, and that its value at the points B, C, D, E, F are respectively 50, 35, 28, 25, 24 lbs. Let the distances BC, CD, etc., represent 3 feet. Draw a diagram of the work done by the force, and find its amount. Find also what the result would have been if no more than the values of P at B, D, F had been given. (1894.)

Here, if considered necessary, a diagram can be drawn to scale, using the given values as ordinates. Then, when the curve is drawn, the area enclosed by the base, the two end ordinates and the curve, is the work done by the force. To find its amount we may use Simpson's Rule, and as the values of the ordinates are known, together with the common interval or distance between them, the area can be calculated.

Sum of end ordinates is 50 + 24 = 74.
,, even ,, 35 + 25 = 60.
,, odd ,, 28.
Hence $74 + 4 \times 60 + 2 \times 28 = 370$.

This is to be multiplied by one-third the common interval; but this is 3 feet, ∴ $\frac{1}{3} \times 3 = 1$.

Hence work done by force = 370 ft.-lbs.

If only the three ordinates at B, D, F were given, then
Sum of end ordinates is 50 + 24 = 74.
,, even ,, 28.
,, odd ,, 0.
$\therefore 74 + 4 \times 28 = 186$.

One-third the common interval is $\frac{6}{3} = 2$ feet.

∴ work done = $2 \times 186 = 372$ ft.-lbs.

Power.—*Power is the rate of doing work*, and a convenient unit must be adopted before the power of any working agent can be estimated. The unit usually adopted is 33,000 ft.-lbs. of work per minute, and is called a *horse-power*. Hence, to find horse-power, it is only necessary to find the work done in unit of time (one minute or one second), and divide by 33,000 or 550. As the questions usually met with involve only elementary calculations, it is only necessary to briefly refer to them here; but the student will find it advisable to work a few examples. These may be obtained from any text-book.

Ex. 4. Find a formula for the work done when a given quantity of gas expands at a constant temperature.

If at first the volume is 10 cubic feet, and the pressure 20 lbs. per square inch, find how many foot-pounds of work will be done when it expands, at a constant temperature, to a volume of 20 cubic feet. (*N.B.*—Hyp. log 2 = 0·693.) (1898.)

Hint.—Here P = 20, V = 10, $r = 2$.

When a given quantity of gas expands at a constant temperature, show how to represent graphically the work done, and justify the construction by reference to first principles. (1899.)

Ex. 5. Show that the work done by a variable force acting through a given distance can be represented graphically by an area.

If the distance, AB, be divided into two equal parts at C, and the magnitudes of the force at A, B, C are P, Q, R respectively, show that the work is

$$AB(P + 4R + Q) \div 6 \text{ units},$$

and state on what suppositions, as to the variation of the force, this formula can be trusted to give a nearly correct answer. (1900.)

Hint.—It will be noticed that this is merely an application of Simpson's Rule, and is equivalent to the second part of Ex. 2.

Ex. 6. A closed straight tube of fine bore contains, when horizontal, two portions of air, each of length a, separated by a mercury filament of length b. If the tube is inclined at an angle θ, prove that the filament will move a distance x, given by

$$b(a^2 - x^2) \sin \theta = 2ahx,$$

where h is the barometric height.

Ex. 7. The resistances on the level being taken at 8 lbs. per ton, determine the horse-power of an engine which is drawing a train of 200 tons up an incline of 1 in 250 at 20 miles an hour. (1898.)

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OUR COMPETITION PAGE

OUR FRENCH PRIZE COMPETITION.

Prize Editor—W. T. THOMPSON, B.A. (LOND.), *French and German Honours.*

Important to Scholarship, Certificate, and London Matriculation Students.

WE should like to specially direct the attention of our readers to the fact that the Board of Education, in the Syllabuses for the Scholarship and Certificate Examinations 1901, requires "no set books" for French and German. Students preparing for these examinations, as well as students for London Matriculation, could not do better than attempt month by month the pieces set for translation here. They are from the best authors, and of varied character. A competitor who does not gain a prize can derive considerable benefit from the exercise. A study of the successful competitor's translation, and of our remarks, will help him to see where he might have done better. If desired, his paper can be returned (fully corrected) by enclosing six stamps together with a stamped and addressed envelope.—ED.

RULES.

1. All translations should be **posted not later than February 8**, and addressed:—*Prize Editor*, Office of THE PRACTICAL TEACHER, 35 and 36 Paternoster Row, London, E.C.
2. Competitors should cut out and send the Coupon which appears on the Back Wrapper page of the current number.
3. Competitors should adopt a pseudonym, and send name and address written on a separate piece of paper.
4. No competitor may take the prize offered more than once in three months.

FRENCH PRIZE COMPETITION.

A Prize of One Guinea will be given for the best translation into English of the following extract:—

Toute passion est égoïste, personnelle, complaisante à elle-même, le sacrifice de la passion ne se fait pas sans un sentiment pénible. Mais en même temps ce sacrifice relève l'être moral à ses propres yeux, et de là naît une sorte de plaisir négatif et ineffable dans l'approbation que nous accordons à notre conduite. C'est la raison qui approuve; cependant cette approbation est accompagnée d'un plaisir grave qu'on appelle le contentement de soi-même, le plaisir intime de la conscience. Ainsi que nous l'avons dit, ce plaisir, si noble qu'il soit, n'est pas la fin de l'action morale. La vraie, la seule fin de l'action morale doit être l'accomplissement de la loi. Se proposer pour fin le plaisir de l'approbation morale, c'est le manquer; car il ne s'attache qu'à un acte digne d'être approuvé, et qui par conséquent n'a pas eu pour objet ce plaisir même. Mais si la loi pure du devoir est le seul motif légitime de nos actions, n'est-il pas permis de joindre à ce motif désintéressé celui de l'approbation morale qui, sans l'altérer, lui donne de l'énergie et vient aux secours de la faiblesse humaine? A cette question, le philosophe Kant répond affirmativement, mais en marquant bien à quelles conditions il fait cette concession. Nous sommes si faibles, et si continuellement assaillis par l'intérêt et la passion; la loi et la raison dans leur absolue pureté agissent avec si peu de force sur la plupart des hommes, qu'il est permis d'appeler le sentiment au secours du devoir.

VICTOR COUSIN.

RESULT OF THE JANUARY COMPETITION.

French.

The prize is awarded to "Florestan," the pseudonym of Mr. T. Vincent, c/o J. Vincent, Esq., Wesleyan School, Great Bridge, Tipton.

First Class.—A. K., Hungary, Johannes, Omega, C. E. M., Oakover, Kettering, Via dolorosa, Agaznog, Wemmick, Chadushah, Il penseroso, Omicron, Chemineau, Débutante, Rioghail, X. Y. Z., Stay at home, Titi parisien, Integer, Rustica, Onslow Rode, Inez, Penholder, Marie Antoinette, Birkie, Sculpin, Manu forti, Hope, A plain woman, Cygnet, Jesmond, B. E. C., La Printanière, Ascanius, Outrecuidance, Myosotis, M. G., Festina lente, Anno Domini, Sydney Carton, St. Antonius, Veronica, Despair, Espérance, Peakite, Retlaw, Snowdrop, I. C. E., Bonhomme, Sunspot, White Heather (Dingwall), The Prodigal Parson, Patience, Perseverance, Aristos.

Second Class.—Uranie, M. H., Stretton, La plume, Shod, Beta, Barney, Cœur de Lion, White Heather (Windhill), Automobile, Penstrowedd, Rutherford, Sah-luma, Esther, Bull-dog, X., Silvester, Bronbrian, Charlotte Corday, Vincit, Borealis, Andromache, Malvoisin, Alexis, Periwinkle, Daisy, Ivanhoe, Nelvil, Amateur, Irénée, M. P., Cornubia, Rosine, Diana, Peggy, West, Acanthus, Crossfell, Erlfurt, Ethelwulf, Penybont-ar-Ogwy, Gitano, Lochaber.

Third Class.—Vwretter Post, Jasper, Furness, Bill Sykes.

Disqualified.—Rule 2—Antonio, Discipulus. Rules 2 and 3—June.

Report.

The holidays are undoubtedly responsible for the diminution of the number of competitors, but the falling off in quality we have observed this time cannot be laid to the same account. It seems to be due to competitors in many cases not having made a thorough study of the piece as a whole before commencing a translation of it. The piece is an extract from one of Paul Bourget's finest psychological romances. The hero is a Don, who has undertaken the self-imposed task of avenging his father's murder, and who is endeavouring to analyse the emotions the discovery of this tragedy roused in him. To understand an extract is the first step towards making a satisfactory translation of it.

French Prize Translation.

THE DEATH OF MY FATHER.

Do I remember? I seem to have passed years in scaling a Calvary of grief! What was my first step on this path so stained with spots of blood? I scarcely know at what point to take up the story of the slow martyrdom, whose last terrors torment me still. The emotions are like shores eaten into by lagoons, which prevent us saying where the sea begins or ends; the land ill-defined, the sands sodden, the uncertain and variable outline of a shore of ever-changing form. It has no boundaries and no outlines. Yet we draw those regions on the map, and we picture to ourselves our past emotions, by reflection and self-analysis. But how unstable and how shifting is the reality! How elusive! What a profound enigma is the precise moment when the heart perceives its wound—a wound like those still unhealed in my own heart. To make my story plain, and to avoid foundering in the painful torpor of dreamy thought which oppresses me like an opiate, let us begin the story point by point. Let us indicate, at all events, the actual occurrence which was the prime and determining cause of all that followed—the death of my father, so tragic, so mysterious. Let us try to recall the emotion which thenceforward overwhelmed me, mingling with it nothing that I have since felt and understood.

PAUL BOURGET.

(*Translation by "Florestan."*)

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THE EDITOR'S TABLE

MODERN LANGUAGE TEACHING.

III.—MODERN LANGUAGES AND MODERN PHONETICS.

l evɑ̃:ʒil ny di k ɑ̃ pø d tɛ̃ aprɛ la nεsɑ̃:s de ʒe:zy, de ma:ʒ d orjɑ̃, averti par yn etwal misterjø:z ka lə 'rwa de ʒyif'ete ne, sɔ̃ vny pur l adɔ:re e lųi fε:r de kado.—leʒɑ̃:d dy katriεm ma:ʒ.

"L'Evangile nous dit qu'un peu de temps après la naissance de Jésus, des mages d'Orient, avertis par une étoile mystérieuse que 'le roi des Juifs' était né, sont venus pour l'adorer et lui faire des cadeaux."—*Légende du Quatrième Mage*, PAUL PASSY.

THE above specimen will convey some idea of the kind of transcription which is now widely used by the members of the International Phonetic Association, of which M. Paul Passy is secretary. It shows at a glance the great advantage and the great disadvantage of a phonetic system of writing. Unfortunately, the disadvantage strikes the outsider the more directly and forcibly. The crabbed characters repel one at first sight; to the unaccustomed eye, they appear to result in nothing but hideous mutilation and deformity; and, indeed, if others share the tenacious conservatism which we cherish towards the normal literary forms of a language, then it is certain that neither the above nor any other reformed phonetic spelling will ever become the received written language. The feeling of attachment to our wonted written medium is, we believe, very widespread. Every one knows that even the national German type and handwriting act as a powerful deterrent to the study of German in England. Phonetic systems, therefore, are evidently impossible as garments in which to clothe our written thoughts.

But, on the other hand, a carefully-constructed, scientific, international system like the one under consideration has vast and varied uses, and deserves to be universally studied by teachers of all nations. Leaving aside its obvious application to the teaching of reading and shorthand, and to the instruction of deaf-mutes and the blind, let us consider it in its relation to the study of modern languages.

We all have observed how certain sounds in each language form absolute stumbling-blocks to the foreigner, some being even a source of trouble to the native. Further, at foreign universities, we note that students of each nation have their special failings, of which they are often entirely unconscious, some even going so far as to endeavour to put the correct student right. The German pronounces the first syllable of the French *pension* as *pank*, while the Englishman brings it out with a sonorous *pong*. In fact, a characteristic of the Englishman's French is frequently its oft-recurring *ding-dong*. Now, when the foreign student studies the French nasal sounds scientifically under a good teacher, with reference both to the organs employed and to the suggestive phonetic sign, he speedily recognises that the French nasal bears little resemblance either to the English *ng* or to the German *nk*. The nasal sounds in *lent*, *l'un*, *long*, and *lin* are figured thus: ɑ̃, œ̃, ɔ̃, ɛ̃—that is, as nasal modifications of the vowels usually written â, eu, o, è.

We must not imagine that there is any inherent virtue in these signs by which they will at once suggest the correct sound to a reader who has never yet heard it. The student will find that verbal descriptions and graphic representation of sounds, intonations, etc., which are strange to him, will suggest very little by themselves. The point is that the descriptive sign will aid the student in his effort to catch the sound from the living teacher, and will also act as a reminder afterwards.

Many unconscious mannerisms of speech, many dialectic singularities may be corrected by the aid of the numerous symbols of this system. The Yorkshireman, who speaks a broad dialect, and yet firmly believes that he has eradicated from his speech every trace of provincial accent, should study M. Passy's books. We once requested such a one, in the presence of Londoners, to pronounce p-u-m-p. The result was a sounding *poomp*, which produced roars of laughter. But the Yorkshireman might retort that the Londoner with his mincing accent says *pamp*. To settle the matter phonetically, with the aid of M. Passy's signs, we should write the Londoner's pump as *pɑmp*, the Yorkshireman's as *puwmp*.

We have said enough to show that this rigid system of co-ordinating sound and sign has nothing in common with the clumsy devices of the so-called "imitated pronunciation." The result of this latter plan would probably be that a student from the north would transfer his north-country accent to his French or German, while a London clerk would speak these languages with a dreadful cockney twang. French *faut* is not the same as English *foh*, nor is *clef* identical with *clay*. Again, imagine the result when the reader is directed to pronounce short German *a* like the *u* in the English word *hut*. This is not bad for a Londoner, but what will the poor Northerner make of it?

The International Phonetic Association employs distinct symbols in many such cases—for example, lingual r = r; uvular r = ʀ; weak r of Southern England = ɹ. The fact that the Association numbers 1,500 teachers of various nations proves the practical utility of these symbols. To those who feel repelled by their strange appearance and apparent difficulty, we can only say that they should procure M. Passy's useful little brochure, *L'Écriture Phonétique*. At the end of a quarter of an hour they will be able to read the "Histoire de Bêta" as though they had known this alphabet for years. It is based upon the Latin alphabet, and is designed for world-wide use, the sign chosen to represent a given sound being the letter which is so used in the greatest number of tongues.

We do not recommend teachers to study the system with a view to reading phonetic texts; for, in our opinion, there is not the remotest prospect that such texts will ever oust the ordinary spelling. But, as a means of acquiring or teaching foreign pronunciation, the new alphabet is admirable. The systematic signs go hand in hand with systematic study of *sounds*, and of the organs which produce them. A student with a dull ear finds his perceptions quickened and refined by the numerous distinctive marks. He can elaborate his studies to whatever degree he may deem expedient, for the system furnishes innumerable devices for indicating not merely pronunciation, but voice-inflection, word-accent, phrasing, etc. Among them he will find some which are awkward and misleading at first. For example, it is confusing to have to read j in a *French* text as though it were German j and equivalent to English y. The accented syllable of a word is also marked in a strange manner by placing the mark *before* its syllable—for example, ge'-og-raphy.

On the other hand, some distinguishing marks will prove most valuable when they have been thoroughly mastered with the aid of oral explanation. Voiceless m̥ and l̥ at the end of French words like *cyclisme*, *peuple*, are often badly pronounced by English learners. The little sign beneath warns them not to follow the English sound which occurs in *schism* and *people*. The German glottal stop is commonly neglected by English speakers, even when they know German well. "They run their words together," their German friends tell them, and the little indicator (ʔ) in a phonetic text or pronouncing dictionary would serve to remind them of this fault. Pronouncing dictionaries in which these useful symbols are employed, and "ideophonic texts" in English, French, and German, such as those advertised in recent numbers of the organ of the Phonetic Association, constitute, we think, a sound practical application of the system, which should win the approval even of those who would ridicule the use of phonetic spelling for the ordinary purposes of written language.

We have already referred in these columns to English text-books which make use of the international phonetic writing—namely, Dent's Modern Language Series. One volume of this series—*Elements of Phonetics*—should be specially mentioned here, as treating directly of the question we are now considering. It is an adaptation by Professor Rippmann of Vietor's *Kleine Phonetik*, and gives a concise, masterly description of the organs of speech, and the *sounds*, considered first separately, and then as connected speech. It is not mere hazy, verbal description, for there are numerous diagrams to illustrate the position and movements of the organs during the production of various sounds. It is well known how much more readily a sound is imitated when the learner has some preliminary notion of the movement

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involved; for example, the teacher pronounces the French û, and then describes the vowel as English *ee* uttered with rounded lips. We have not space to discuss the work fully, but heartily recommend it, not only to the student who desires to improve his pronunciation, but also to the efficient language teacher, who will find it interesting to compare what he reads with what he has himself noted during intercourse with speakers of various nations.

English students who can read French will find abundant hints in M. Passy's useful little book, *Les Sons du Français*. Not merely the practical student who aims at speaking and teaching French well, but also the thorough philologist, who loves to trace the language back to its far-off sources, will find profit in this book. It is part and parcel of modern scientific method to gather from the present the data for the study of the past. The geologist ponders on agencies which he sees in action now, and from them infers their action in bygone æons; the anthropologist gathers every possible fact of present-day savage life, and then proceeds to reconstitute the life of prehistoric man; so the student who would understand the historical development of French will first master thoroughly *Les Sons du Français Moderne*. Should he find that, even with the aid of long explanations, certain signs, representing unknown sounds or unnoted peculiarities, are only dimly comprehensible, that will have the good effect of stimulating his faculties when among French people. M. Passy discusses sounds in general, the sounds and organs of speech, and phonetic representation. We refer the intending reader specially to the list of phonetic characters on page 21. The lack of real phonetic separation between *words* in French is one of the strangest facts of the language. We must quote what M. Passy says upon this important point:—"Non seulement il n'y a jamais d'arrêt entre tous les mots, mais il n'y a aucun fait matériel qui marque la limite des mots. Le mot est une unité logique, mais non pas fonétique." Examples are also given from letters written by French illiterates and children—for example, "Il marche *a sait* bien (*assez* bien): je vous *zenserait* reconnaissant (*en serais*)." In a word, there is no difference in French between *les annes* and *les zones;* yet in English we distinguish between *an aim* and *a name*. Word accent, phrasing, emphasis, rhythm, and versification are treated of in § 77 *seq.*, and deserve most careful attention from English students. The normal accent, and its displacement to indicate emphasis (page 50), is perhaps the most important part of the book to an advanced English student. The chapters on what we may call French elocution (voice inflection, etc.) will convey little meaning to those who have not associated with French people, but will probably serve to show how much there is for the foreigner to learn. At the end there is a good collection of phonetic texts, one of which is given in the so-called *écriture scientifique*, and in which the indications are so numerous and so subtle that we regard it as a specimen of over-elaboration, though perhaps even this would prove useful to those who had mastered each minute symbol direct from the inventor. We hope this very ably written book will be widely read in England.

Another excellent work, written upon the same subject, but from a somewhat different standpoint, is the *Traité de Prononciation Française*, by Professor Aug. André, of the University of Lausanne. M. André's work is quite independent of the International Phonetic Association, has its own system of symbols, and appears to aim at simplifying the difficulties of English and German students of French. The existence of rival systems of phonetic transcription is unfortunate, and, to the learner who does not make a resolute choice, confusing. For instance, M. André retains the accents, and therefore writes e, é, è, which in the international system become respectively ə, e, ɛ. What we like best in Professor André's treatise is the clear distinction drawn between what is essential and what is unimportant to the foreigner. He points out what is affected or vulgar, variable or normal, Parisian or provincial, in French pronunciation. He quotes his authorities, and now and then becomes quite anecdotal and interesting. It is by no means a mere dry dissertation, yet always eminently practical. Exercises, lists of illustrative words and phrases, are given. All the great difficulties of the subject are well discussed, and at the end there is a good index of the syllables and words mentioned, so that the work will serve the double purpose of an interesting brochure on pronunciation and a handy little pronouncing dictionary.

Lack of space forbids us to do more than refer to M. Passy's *Leçons de Choses* and the corresponding book in phonetic characters, *Elements of Spoken English*. Briefly, they are the application of international phonetics to the direct method of teaching languages, and will prove most interesting little works for English teachers. According to the Maître Phonétique, "the aim pursued by the Association is the development of scientific practical study of spoken languages, by utilising the most recent results of phonetic researches and pedagogic experience." The Association assigns the chief place to the study of everyday spoken language, advocates minute attention to the sounds of the language, the use of phonetic symbols, the acquisition of useful phrases and idioms by the reading of pieces written in bright colloquial style, the inductive teaching of grammar, object lessons, explanations of pictures, etc., given in the foreign tongue, the postponement of translation and the systematic study of grammar and literature for later studies.

Teachers who are interested would do well to write to the Association Phonétique, 11 Rue de Fontenay, Bourg-la-Reine, Seine, France.

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Excerpts from French Authors. By Henri Blouet, B.A., author of *Elementary French*, etc. (New Edition.) This is a new edition of a work which we reviewed in the issue of THE PRACTICAL TEACHER for October of last year. Many of the imperfections to which we then called attention have been removed, and the book is by so much the better; but even in its present condition we should hesitate to recommend it. The extracts selected remain as before, and we still think that a large proportion of them are uninteresting, and would be calculated to repel the student rather than to increase his desire to extend his knowledge of French. A large portion of the work is devoted to extracts dealing with scientific subjects, and possessing very slight literary merit.

Other extracts seem to be only translations into French of extracts from English newspapers; and that the selections have not been made with the requisite care and judgment would appear from the concluding sentences of one dealing with the Dreyfus case. Whilst taking the view of the case which is most in conformity with English opinion, it concludes:—"Ils [the Antisemites] auraient voulu même la mort de l'innocent, sans se rappeler, les insensés, que ces choses-là se paient fort cher. Ils oubliént que les Romains ayant consenti à la mort du doux galiléen Jésus, un sémite innocent aussi, il en résulta pour les races celtiques et germaniques qu'elles durent renier et abandonner leurs dieux, leurs sublimes et mystérieuses théogonies, pour subir le joug dur et cruel de l'impitoyable Adonaï [Hebrew word for God]; qu'elles durent consentir à la monstrueuse adaptation de toutes leurs croyances, de toutes leurs traditions, de toutes leurs conceptions aux lois inflexibles et anormales de la religion d'une autre race." This view of the conversion of the nations of western Europe to Christianity will only be endorsed by few people, and to many the passage is likely to prove offensive.

We should be doing M. Blouet an injustice if we held him immediately responsible for the vocabulary, even in its present improved state. Internal evidence suggests to us that the vocabulary and notes have been drawn up by some one whose knowledge of French left much to be desired. For instance, in the first extract we read, *Le miroir* (of a telescope) *fondu dans les glaceries de Jeumont*. The word *glaceries* is interpreted "ice-houses" in the vocabulary. *Etaler* is given as to "sprawl," when *s'étaler* is evidently meant; and *refend* in *murs de refend* is not explained. The student who endeavours with the help of the vocabulary to attach some meaning to *Ces déductions logiques de faits nettement contrôlés font le plus grand honneur à l'esprit scientifique du grand écrivain* will be landed in a state of mystification, for *contrôler* is given as "to control," "to stamp"—both correct enough renderings, but not the rendering the student requires. The absence of necessary notes which marked the first edition has been only very partially remedied. Three notes have been added, and of this small number one contains a very puzzling English rendering of a French idiom. The phrase explained occurs in the sentence, *A la Chambre des Communes une interpellation avait été adressée aux ministres, qui n'en pouvaient mais*. The following note appears at the bottom of the page:—"N'en pouvoir mais (id.), *to have nothing to do with anything*." It would be better to leave the student to the help afforded by his dictionary rather than to supply notes like the one referred to.

Practical Book-keeping. Part I.: Elementary. By W. D. Oldham, Chartered Accountant, and W. E. Holland, Incorporated Accountant. The object of this work is to teach a practical method by which to keep books of account by double entry; and this object will be fully accomplished if the student will go carefully through the book, and work the exercises and answer the questions based on the subjects taken.

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We can confidently recommend this work for private students, schools, and technical institutes.

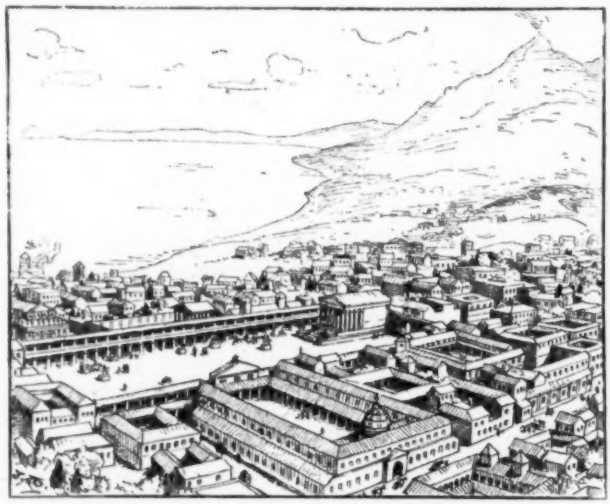
GEORGE BELL AND SONS.

Bell's Latin Course. Part I. By E. C. Marchant, M.A., and J. G. Spencer, B.A. This little book is intended for the use of young beginners; its subject-matter includes the first and second declensions of nouns and adjectives, the indicative mood of the verb "to be" and the first regular conjugation, and the personal pronouns.

We used to learn how King Alfred the Great in his childhood was induced to learn to read by the attractiveness of an illuminated Saxon missal. The attractiveness of this little book will, we are sure, lead many a child to eagerly learn what must have been a dull and tiresome task to his forbears.

Interesting and useful illustration is to-day always expected in such subjects as history and elementary science. At first sight, Latin grammar would seem almost as impossible of pictorial aid as algebra; but here we have a book full of pictures as useful to the teacher as they must be attractive to the child.

There are four full-page coloured pictures, and a large number of clear outline drawings, one of which, by the courtesy of the publishers, we reproduce.



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The utility of these is apparent in the exercises. Every exercise forms a continuous story, or a dialogue, or a letter, and the subject of it is the accompanying picture—a much better plan than the old one of building up an exercise with a number of totally disconnected sentences. One is often reminded by them of the story of Scott finding a farmer waiting to see him in his library. While he waited, he had picked up a dictionary from the table, and was reading it. When asked how he liked it, he replied that the tales were interesting, but very short.

The authors are to be highly complimented on the success with which they have told complete tales with the very little materials available. For instance, with the first two declensions and a few verbs in the present tense, we have the story of Dædalus and the Minotaur, and of the conquest of the Carthaginians by the Romans, each with a fine picture. A little later comes a dialogue between Ulysses and Polyphemus; then an exercise which tells the story of Ulysses' escape: two or three pictures illustrate this. Other stories are of Boadicea, of Æneas, of the Wooden Horse. There are drawings of Roman deities, arms and armour, temples and camps, the Forum, and so on, each with an exercise following.

Points which will appeal to all practical teachers are these: everywhere the Latin is pure classic Latin, not the Anglo-Latin so long used; and almost always the idea is taught before the rule which formally embodies it is given. We heartily recommend this book to all who teach beginners in Latin.

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A Brief Survey of British History. By Townsend Warner, M.A. Mr. Warner tells us in his preface that his aim has been to make a simple selection of the most important factors, or chains of events in each period, and to treat these in more detail, to the exclusion of the less characteristic. It is quite evident to the most casual reader that this purpose has been successfully achieved. The style is novel, attractive, and easy. The striking features are very judiciously chosen and very carefully linked. The book is well illustrated with maps and plans. There is a very useful summary of events at the end.

A First Course in British History. (Douglas Reader IV.) By G. E. Todd, M.A. This reader, though written primarily for Scotch schools, is well adapted to suit the latest Code for English schools. The course is an interesting and carefully arranged one, covering British history from the earliest times. The stories are very interestingly written and thoroughly well illustrated.

A Second Course in British History. (Douglas Reader V.) By Robert S. Rait, M.A. This book is written specially in accordance with the "concentric" scheme of history (Scotch Code, 1899). It is meant to succeed the first course. Careful attention has been paid to show the relation between cause and effect. The arrangement of stories is good, and the style is attractive and clear. We can confidently recommend it to all for whom it is intended. The illustrations and print are exceedingly good.

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The Nineteenth Century. By A. J. Balfour, M.P. The many admirers of the First Lord of the Treasury—and their name is legion—will read with pleasure this inaugural address, delivered by Mr. Balfour in the Senate House, Cambridge, to the assembled university extensionists. The chief points made by the lecturer are such as commend themselves to the common sense of all thinking people—namely, that it is by the development of science that the nineteenth century has progressed most; and that, in the near future, there will be no mention of that conflict between true science and true religion which ignorant clerics and equally ignorant scientists have delighted, in their narrow bigotry, to prate about.

HENRY FROWDE, OXFORD UNIVERSITY PRESS.

The Three Friends: A Story of Rugby in the Forties. By A. G. Butler, M.A. That this story of school life will be popular amongst Rugby boys goes without saying. There is always a charm, in comparing "then" and "now," in seeing which of the old customs have remained, and which have become extinct. To those who have not been to Rugby the story will not be very interesting—there is too much local colour; and although the incidents are well told, they are not of entrancing interest, and, to quote the criticism of a young friend to whom we referred the book, "nothing seems to happen."

HACHETTE ET CIE.

Le Page de Jehanne. Par la Comtesse de Houdetot. Ouvrage illustré de 59 gravures par Ed. Zier. This is one of those large and handsome volumes which the Christmas season annually evokes from the well-known Parisian firm of Hachette et Cie., veritable *éditions de luxe*, of a much larger page and more decorative exterior than the Christmas books that appear on the foggy side of the Channel. The story is of the times of Joan of Arc, as we still persist in calling the mysterious shepherdess of Domremy. It has for its hero a young gentleman of France, orphaned by the ghastly bloodshed of the period, who espoused the cause of the Dauphin at the moment when the maid began her career of deliverer of her country, and who became her page and standard-bearer. Naturally our countrymen come in for hard knocks, both from the arms of their foes and from the adjectives of the writer, and it will be some comfort to the English boy who reads the tale that the events

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☞ *See Page lxxiv.*

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happened a considerable time ago. But it is a tale well worth reading, and is instructive from its careful reproduction both of the habits and the language of the period. The latter feature, it must be granted, will not tend to render any more easy for the young reader the none too easy French of the authoress.

Terre de Fauves. Par Pierre Maël. Ouvrage illustré de 52 vignettes par A. Paris. Deuxième Edition. This is another volume of the splendid series known as the *Bibliothèque des Écoles et des Familles*, uniform with that mentioned above. It is a story of adventure, and crammed full of excitement from beginning to end. There are three principal actors—the Englishman, who is a Scot; the American, who is a girl in male attire; and the Frenchman, who is a hero and the natural leader of the party. The task which these three set before them is no less than to climb Mount Everest. Their adventures and escapes are sufficiently exciting to ensure a marvellous improvement in the knowledge of French on the part of any boy who once begins the perusal of the book; assuredly he will read every page of it, cost what it may. The illustrations are worthy of the book.

HODDER AND STOUGHTON.

Self-Educator Series: French. By John Adams, M.A., B.Sc., Rector of the Free Church Training College, Glasgow. We must confess to having opened this book with a certain amount of prejudice against it. "Self-educator" is too often used as a title for books which get a large sale by minimising the difficulties of the subject which they profess to expound. It is the great merit of Mr. Adams's book that it both recognises the difficulties of the subject and faces them. This may seem very trite, but it is nevertheless rare to find a French grammar, especially if written by a Frenchman, which treats the subject from an English standpoint. Mr. Adams, looking upon the French language from an English standpoint, rightly passes very lightly over the points of resemblance between French and English, and insists upon the differences between the two languages. We have never met with a text-book which anticipates in so clear a manner the difficulties of an English student who has to deal unaided, except by text-books, with French. Mr. Adams, in his remarks on the pronunciation of French, clearly indicates the limits of text-book help. But while it is next to impossible for a student to acquire a practical knowledge of French pronunciation without a teacher, he could not get more valuable preparation for *viva voce* assistance than by studying Mr. Adams's chapter on pronunciation. The remarks on the phonetic value of accents, the mute *e*, and the tonic accent in French, are particularly valuable to the English student. We can very heartily recommend Mr. Adams's book to beginners in French.

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Helps to the Study of the "Expostulation." By W. H. S. Jones, B.A. We can speak in terms of high praise of this little book, which has been specially prepared by Mr. Jones of York Diocesan Training College for first year pupil teachers for April and October 1902. The poem—a didactic one, intended to teach reverence for God and His works—is by Cowper; and Mr. Jones has provided students with everything in the way of help to an intelligent appreciation of a very meritorious piece of composition. Furthermore, in his hints the author gives some excellent advice, which we recommend pupil teachers to study carefully and follow implicitly. In particular, we agree with Mr. Jones that in reading the poem the notes should not be allowed to overshadow Cowper; for, after all, it is from Cowper rather than from the notes that inspiration is to be derived. The section on figures of speech is very nicely done, and altogether the help accorded is just such as is likely to be useful to the reader; hence we recommend Mr. Jones's little book (which the publishers have produced admirably, the interleaving being in particular praiseworthy) to the notice of pupil-teacher instructors throughout the country.

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The illustrations are as refined and pleasing as the literary part of the book.

We cannot help thinking that a "reader" of this kind is a desideratum in the elementary school if the children are to be adequately prepared for entering, later on, into the wide world of literature that awaits them outside.

T. NELSON AND SONS.

Cornelii Nepotis Vitae Miltiadis et Epaminondae. By C. J. Phillips, M.A., Stockwell Pupil Teachers' Centre. A very handy edition. The introduction and the notes are simple and to the point. The notes especially show the hand of the practical teacher who knows just where a beginner will need help. The full vocabulary will save the labour of hunting the dictionary through.

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